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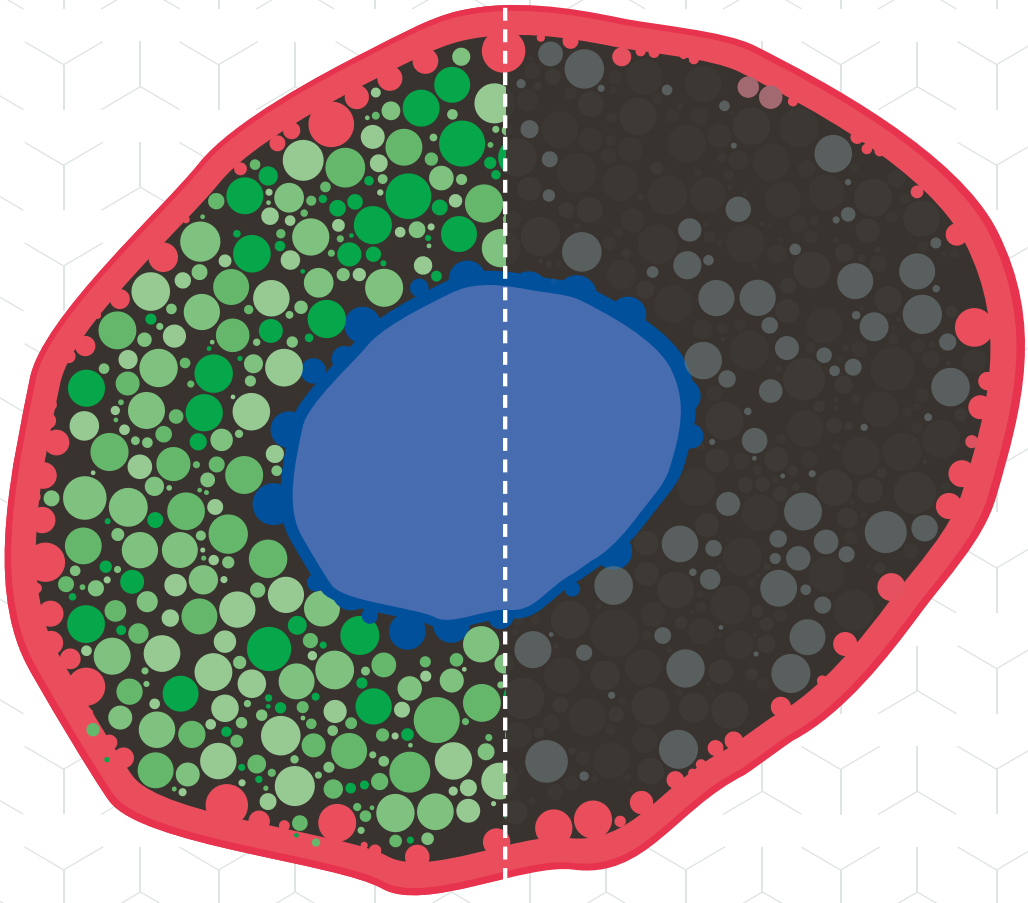

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1. Bradbury, A. and Plückthorn, A. 2015. Reproducibility: Standardize antibodies used in research. Nature. 518(7537), pp.27-29.

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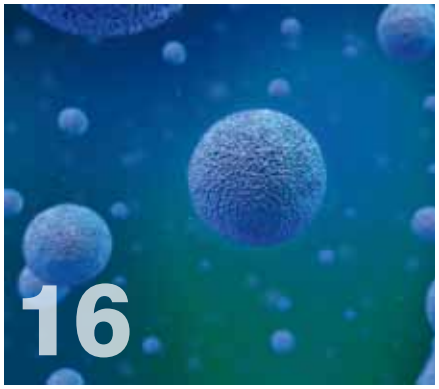

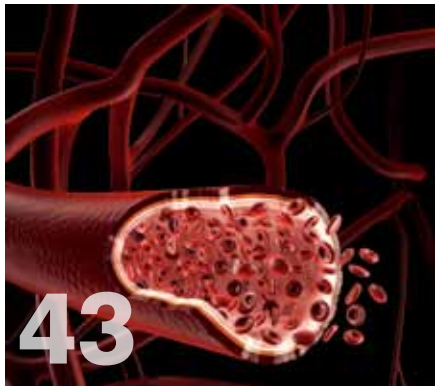

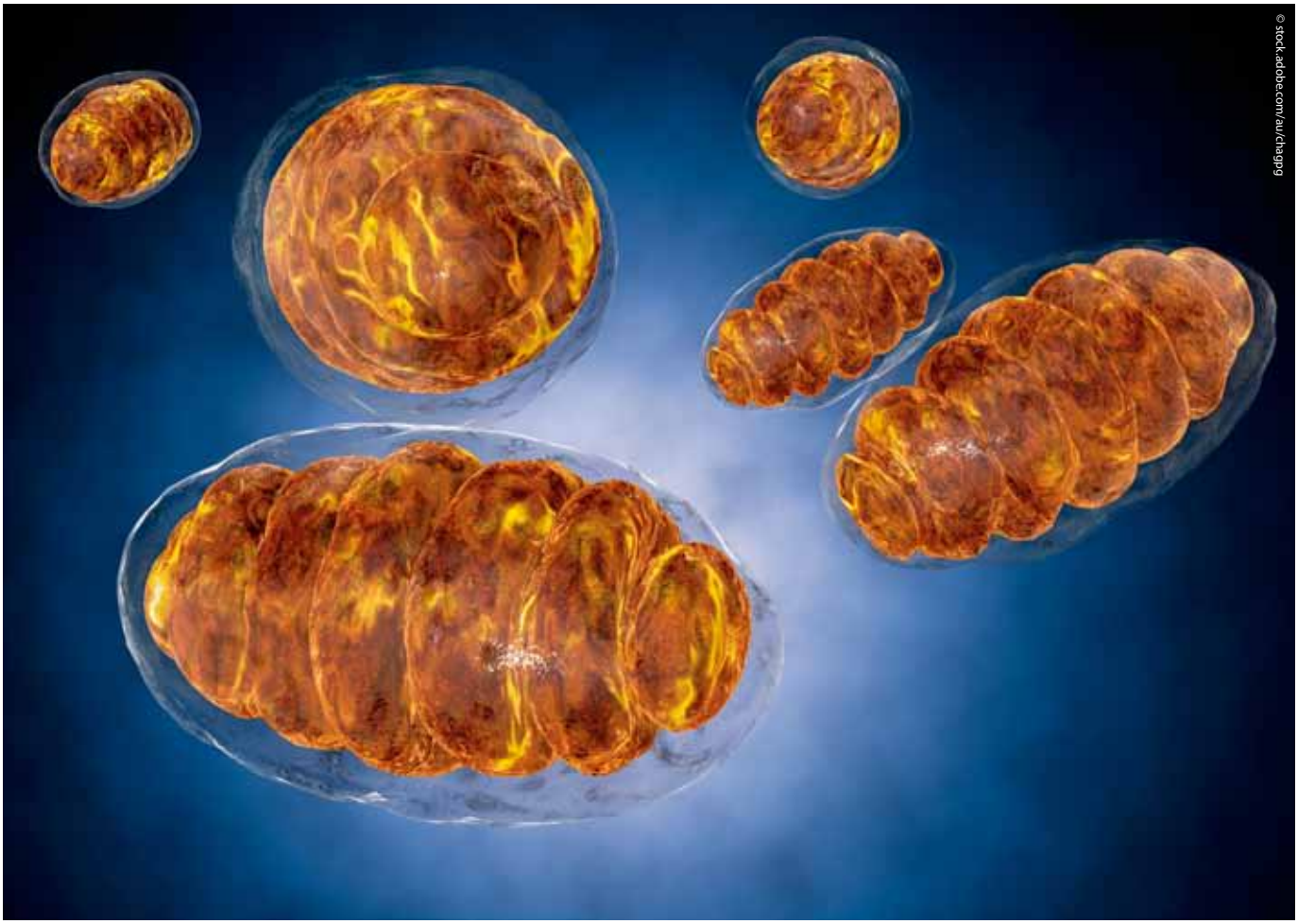

Australia may soon become the second country in the world to legalise mitochondrial replacement therapy, an IVF technique that could prevent mitochondrial disease being passed on from mother to child.

In this issue's lead article, Dr Ainsley Newson, Associate Professor of Bioethics at Sydney Health Ethics, University of Sydney, talks about mitochondrial donation, targeted testing and other ethical dilemmas ahead of the AACB AIMS 2018 Combined Scientific Meeting. Dr Newson, who specialises in ethical issues in genetics, genomics and emerging biotechnologies, will be delivering the closing plenary 'The end of targeted testing? Should patients routinely be given more information?' at the 2018 combined scientific meeting of the Australasian Association of Clinical Biochemists (AACB) and the Australian Institute of Medical Scientists (AIMS), to be held from 3–5 September at ICC Sydney.

The AACB AIMS 2018 Combined Scientific Meeting combines the AACB 56th Annual Scientific Conference and the AIMS 47th National Scientific Meeting. This year's theme is 'Diagnosis to Cure' with related topics to be explored on each of the three days — on day one the main topic will be metabolism; day two will focus on cancer — molecular diagnosis and classification, immunotherapies and drug treatments; and on day three chronic diseases such as diabetes, kidney disease, autoimmune conditions and bleeding disorders will be discussed.

This issue also features two speakers presenting at ComBio2018, a major ASBMB conference held each year, in association with other organisations, to be held from 23–26 September 2018. This year's ASBMB Grimwade Keynote Plenary Lecture will be delivered by Nobel prize-winning American cell biologist Randy Wayne Schekman. Renowned plant biologist Keiko Torii will deliver the Annals of Botany Lecture at the major conference. To read insights from these two experts, please visit pages 16 and 34, respectively.

We also report on an international team of scientists' two-month expedition — that took them 400 km north-east of New Zealand — to study an underwater volcano (page 22).

This issue features many other interesting and insightful stories on a variety of topics.

Regards,
Mansi Gandhi
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Mansi Gandhi

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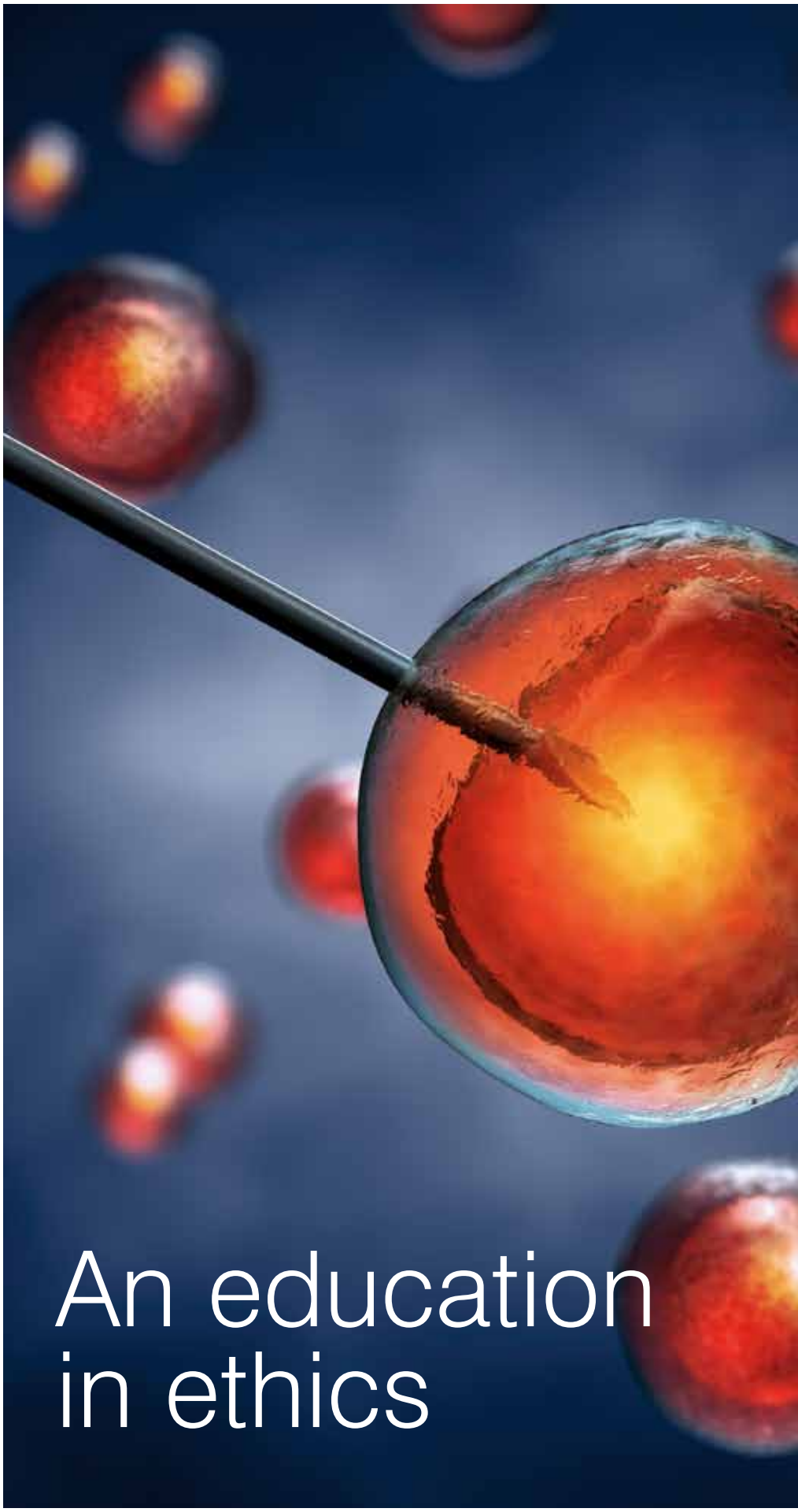
Lauren Davis

An education in ethics

Dr Ainsley Newson*, Associate Professor of Bioethics at Sydney Health Ethics, University of Sydney, talks mitochondrial donation, targeted testing and other ethical dilemmas ahead of the AACB AIMS 2018 Combined Scientific Meeting.

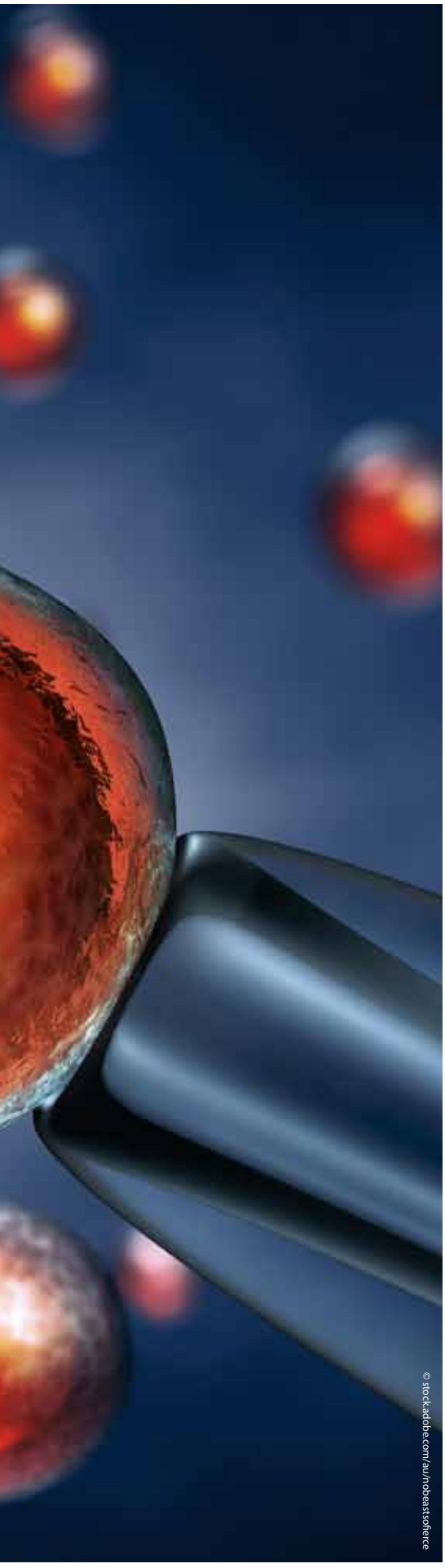


Lab+Life Scientist: How did your interest in bioethics begin?

Dr Ainsley Newson: My interest in bioethics was sparked by a couple of things that happened to me when I was still a teenager. First, one of my biology textbooks in high school had a genetics chapter — and I devoured it. I was absolutely fascinated by the way that we are linked together and what that might mean for who we are and what we do. Second, at the start of my final year of high school I had the opportunity to attend what is now called the National Youth Science Forum, which is geared to show students the huge range of careers in science. At this event, I had the opportunity to meet someone who worked in government, and they provided me with a copy of a committee report on genetic engineering. This report opened my eyes to the huge questions around the social, ethical and regulatory implications of genetics. From that point, I knew I wanted to work in bioethics. Thinking about it now, I am incredibly fortunate that I have ended up exactly where I set out to be.

LLS: Your research interests include mitochondrial donation, which a Senate committee recently recommended legalising in Australia. In your opinion, is it safe and is it ethical?

AN: As an academic in bioethics, it is not for me to say whether mitochondrial donation is safe or not. That said, there has been some careful consideration of this question in numerous countries. But it's also important to note that we are never going to get to a point where this technology has zero risk. And so the question from an ethical perspective is what level or understanding of safety is the point at which we feel comfortable to allow this technology to be used. There is also a secondary question, which is to ask to whom that decision about safety belongs. Does it belong to regulators? Does it belong to the scientists and the clinical providers of mitochondrial donation? Or does it belong to those who might be choosing to use this technology?



We need a conversation around the fact that achieving perfection is not only impossible, but actually also risks losing things that contribute to the richness of who we are as a group of humans forming a society.

A Senate committee recently made some recommendations that could be said to have set Australia on a path to eventual legalisation of mitochondrial donation. This is not going to be a straightforward process, because of the kind of legislative instruments that currently operate in this space. I was one of the academics who gave evidence to this Senate enquiry and in that I stated that I cautiously endorsed mitochondrial donation. It can be ethically used; however, this is not to say that it should be a technology that we enter into frivolously. To me, the two most significant issues are firstly why it is that we value genetic relationships between parents and children — for it is the desire for this relationship that is the entire reason why mitochondrial donation is sought to be used by couples who are at risk of passing on mitochondrial disease. Is genetic relatedness between parents and children something that has absolute value, or do we value it merely because we are socially conditioned to do so? Second, we need to think about how we treat each of the stakeholders. In the United Kingdom, the process of egg donation for mitochondrial donation is set up so that it is up to the donor herself whether to be identified to the person who might be born. I think that this could mean that children born of mitochondrial donation end up having different information, depending on the decision of the person who made the donation. We shouldn't make those kinds of distinctions. Both as a form of recognition of donors and also to allow the person born to access any relevant information in the future, Australia should not allow anonymous egg donation. I'm really pleased that the Senate committee took this position in its report.

LLS: Is there any merit to the argument that mitochondrial donation could be the first step on the slippery slope to designer babies — and if it is, there anything wrong with that?

AN: Some argue that mitochondrial donation is step one on a very slippery slope to the creation of so-called designer babies. I don't make that argument and I don't think it has any merit. First, mitochondrial donation is designed to be used for a very specific purpose: to avoid the birth of children who will grow up to live with debilitating diseases with significant morbidity and mortality. Second, the slope is not that slippery. We can use regulation to limit any potentially concerning applications of mitochondrial donation: we can control who can have access to it and who can offer it.

But as we are also getting closer to the point of using reproductive technologies to prevent other kinds of diseases (such as through genome editing of nuclear DNA), it's time to have some discussions around our recognition and acceptance of diversity and difference in society. We have a tendency towards controlling variability. We have a tendency to try to limit anything that departs from the 'normal'. But I don't think that's realistic as to what parenting and life in general are like. We need a conversation around the fact that achieving perfection is not only impossible, but actually also risks losing things that contribute to the richness of who we are as a group of humans forming a society. Yet, I also think that there are certain conditions which it seems entirely reasonable to wish to avoid a person being born with, if there were safe, equitable and affordable steps that could be taken to do that.

LLS: You're a keynote speaker at the upcoming AACB AIMS conference. Why do you think the conference organisers were particularly keen to seek out your expertise for this event?

AN: I think the closing plenary at the upcoming AACB AIMS conference is designed to give the audience a perspective that they might not otherwise hear in their daily work. I'm hoping to inspire members of the audience to critically reflect on views that they might intuitively hold but have never explicitly questioned.

LLS: What topic will you be discussing at the conference?

AN: I will be discussing the recent phenomenon in medicine to use testing opportunities to provide increasing volumes of information to patients. This

can both be in the context of reporting information that was identified as a surprise during the testing process (incidental findings), or something that we deliberately look for. Two questions arise. The first is how we should go about this process of managing expectations around what might come out of testing. Second — and this is the question I'll focus on — I'd like to determine whether we should routinely look for more things rather than less when testing. My presentation will be informed by some work that I've been doing with colleagues at Sydney Health Ethics that looks at the relationship between information and autonomy. We've been questioning this idea of whether autonomy can merely be promoted through providing more information.

LLS: Would you be able to summarise a couple of the arguments for and against giving patients more information rather than less?

AN: One reason in favour of giving patients more information rather than less is that it enables a single test experience to potentially be more valuable. A test could not only answer the clinical question that led to it being ordered in the first place, it could also cause additional diagnoses to be suggested. If these are conditions where there can be a treatment or an intervention, then arguably that's quite a valuable thing to do. However, I have a few reasons to be cautious. Firstly, I'm doing some research in the area of overdiagnosis and I worry very much that areas like biochemical testing and genomic testing are not yet supported by an evidence base to support routinely offering predictive risk information. Returning more information rather than less can generate a cascade of further intervention, including further invasive testing, when a person may never have gone on to develop the condition. We should not be routinely offering this information until it meets agreed evidence thresholds. Additionally, theoretical arguments can be had around the relationship between information and autonomy. There is a problem in the way that autonomy is discussed in a lot of bioethics literature, in that the way to promote autonomy seems to be through the provision of information. Now, providing information is of course important. But information alone cannot guarantee autonomy and it is certainly possible to limit autonomy through providing too much information. We should be designing practices in clinical testing to ensure that we don't automatically introduce the provision of more information just because we can.

LLS: What do you think is the biggest ethical dilemma currently in the areas of genetics and biotechnology?

AN: That is a really hard question. If I had to pin it on one thing, I think I would say that the biggest dilemma to me is a perfect storm of under-regulation and over-commercialisation, meaning that new technologies are being pushed through before they're ready and before their appropriate clinical usages have been defined. We are currently living in a world where hype plays a big role in whether things happen or not. Our climate is one in which patient voices are incredibly important and appropriately so, but we also need to try and ensure that those patient voices are cognisant of the limits of information. When there are potentially conflicting interests at play, which are not always made transparent, then I worry that patients could be clamouring for inappropriate technologies. Instead, I think we should proceed from a basis of defining clinical needs and then adapting technology to meet them. What worries me is that at the moment it's the other way around: clinical needs are being created to meet new technologies.

LLS: Finally, are you excited by the future of science and biotechnology, or are you concerned that new technologies are coming along too fast for us to properly consider all ethical concerns?

AN: I'm really excited about new technologies that come along. I think the power of things like genomics help us to understand who we are and to offer a diagnosis to a person or a family who until now have not had any answers is incredibly important. That said, I think broader application of these technologies is sometimes happening too fast and without justification. If I had to describe my approach, I would say that I'm focusing on what I call prudent implementation of new technologies and part of that prudential or precautionary approach is to make space to undertake critical examination of ethical and other related aspects when implementing them.

**Dr Ainsley Newson will be delivering the closing plenary 'The end of targeted testing? Should patients routinely be given more information?' at the 2018 combined scientific meeting of the Australasian Association of Clinical Biochemists (AACB) and the Australian Institute of Medical Scientists (AIMS), to be held from 3–5 September at ICC Sydney. Dr Newson has published over 80 refereed papers and book chapters on the ethical aspects of emerging genetic and reproductive technologies and their implementation, co-chairs the Education, Ethics and Social Issues Committee of the Human Genetics Society of Australasia and sits on the NSW Health Clinical Ethics Advisory Panel. She is a regular commentator on ethical issues in genetics, genomics and emerging biotechnologies.*

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Super-resolution microscopy comes to Westmead

The recent installation of an Oxford Nanoimaging single-molecule microscope at the Westmead Research Hub will provide researchers with much-needed super-resolution imaging capabilities. Available in Australia through AXT, the microscope will allow researchers to observe cellular interactions at the nanoscale, giving them greater insights into how diseases such as cancer behave and increasing the chance of developing breakthrough cures.

The Nanoimager is a super-resolution microscope that offers biological researchers a range of imaging modes, including direct stochastic optical reconstruction microscopy (dSTORM) photoactivated localisation microscopy (PALM), total internal reflection (TIRF), highly inclined and laminated optical sheet (HILO) and structural illumination microscopy (SIM) in a single instrument. Other key design features include compact size, internal active vibration damping, a streamlined optical path and a robust design to ensure the most stable of images are produced without the need for optical benches or darkrooms.

"We have been interested in adding super-resolution microscopy capabilities to our facility for some time," said Dr Laurence Cantrill, an advanced microscopy and imaging specialist at Westmead's Kids Research, the research arm of the Sydney Children's Hospitals Network. "Solutions that we had previously looked at were usually too expensive. The Nanoimager was not only affordable, but also compact and futureproof.

"Its flexible design gives us the capability to add new imaging modalities down the track to cater for new research areas that we may not even be aware of yet, making it ideal for a multi-use facility such as ours. Evaluating the system last year, I was convinced that this microscope provided us with a solution that will suit the numerous and varied researchers in our organisation."

The Nanoimager will be located at the Westmead Research Hub, where it will serve researchers from nearby hospitals and research institutes as well as the University of Sydney. Dr Cantrill noted, "Having the instrument located locally is not only convenient, but also critical for many of the time-sensitive live cell studies that we carry out."

Dr Cantrill expects that it will be used by researchers in areas such as: cancer research from its origins in telomere dysregulation through to its physiology and processes of invasion and migration; tracking the herpes simplex virus (HSV-1) in neurons; looking at damage and repair in cell membranes in muscular dystrophy; unravelling the early stages of HIV infection.

Dr Cantrill is grateful to the Ian Potter Foundation and a private philanthropist for their financial contributions that helped secure the Nanoimager.

Dr Laurence Cantrill demonstrates the super-resolution capabilities of the Nanoimager to fellow researchers.

Real-time tool to help treat drug-resistant tuberculosis

Australian researchers have designed a computer-generated model that will allow clinicians to tailor effective therapies for individual patients with multidrug-resistant tuberculosis (MDRTB), reducing drug resistance globally as a result.

Multiple antibiotics are used to treat TB, but the treatment process is long, and the emergence of drug-resistant bacteria is a considerable threat to global health. But this could be all about to change thanks to researchers from The Peter Doherty Institute for Infection and Immunity and The University of Melbourne's Bio21 Molecular Science & Biotechnology Institute, who used cutting-edge genome sequencing technology to identify an MDRTB mutation in a particular patient.

Armed with this information, PhD student Malancha Karmakar developed a 3D computational approach to determine that a drug being used to treat the patient called pyrazinamide was ineffective due to the mutation. Rather than waiting two years (the standard treatment time for MDRTB) for the patient to complete treatment with pyrazinamide only to rule it redundant, the researchers were able to replace it with a different drug immediately.

Study co-author Associate Professor Justin Denholm, Medical Director of the Victorian Tuberculosis Program at the Doherty Institute, said the new tool is a game changer, noting that what would normally take decades in identifying the effectiveness of a TB drug could now just take a matter of hours.

"Right now, to use genetic tests to reliably predict whether a drug will be effective, someone needs to have been treated with a drug, failed that therapy and to be found to have a gene mutation," Associate Professor Denholm said.

"Then you need enough people around the world to have that pattern to inform what treatment you prescribe for that particular mutation. It can take years."

Co-author Professor David Ascher, from Bio21, said by understanding how mutations work within 3D space, the team could identify likely resistant mutations that have never arisen before.

Once the tool is fully developed the researchers plan to make it available through the web, meaning clinicians around the world could enter the resistance mutations in the system to determine effective treatment regimens for their patients. In the meantime, the study results can be viewed in the *American Journal of Respiratory and Critical Care Medicine*.

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CSIRO announces Earth observation centre

CSIRO has announced the establishment of its new Centre for Earth Observation, focused on collecting and analysing data about Earth from space.

The centre will help Australian researchers maximise the benefits of observing Earth from space and further develop Australia's space sector, which is estimated to be worth over $3 billion per year. It will coordinate a range of Earth-observing activities within CSIRO and also be a catalyst for engagement with Australian businesses, other government agencies and research organisations.

"The development of new products and services based on satellite-derived data presents a growth opportunity for Australia's space sector," said Dr Dave Williams, Executive Director for CSIRO Digital, National Facilities and Collections.

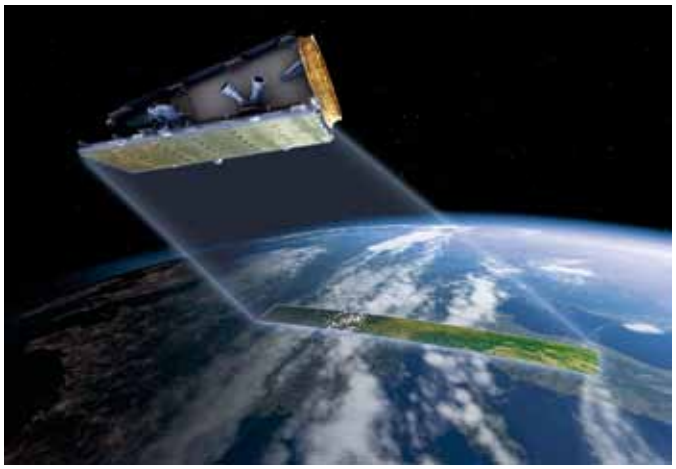
"Our new CSIRO Centre for Earth Observation will be an open door for governments and businesses to access the wealth of CSIRO's expertise as well as those of our partners."

The centre's new director, Dr Alex Held, is meanwhile an international expert in Earth observation programs and policy, remote sensing and vegetation mapping.

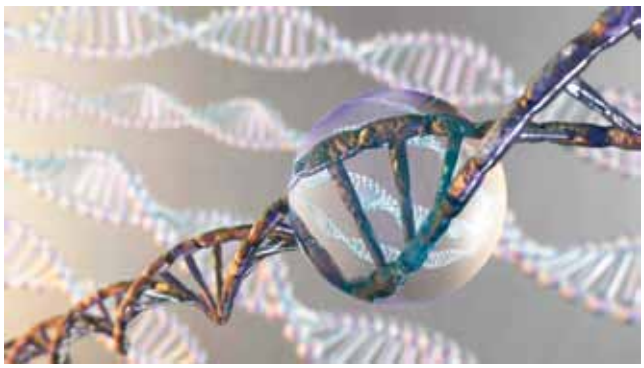
"Our goal is to provide technical support to the Australian space sector and help streamline research and the operation of projects through advances in remote sensing technologies," Dr Held said.

The centre has already signed its first agreements, including one on satellite calibration and validation with CSIRO's partner, Geoscience Australia, for the Digital Earth Australia program.

In addition to being a key partner for industry and government, the centre will support Earth observation science across CSIRO and represent Australia on bodies such as the international Committee on Earth Observation Satellites (CEOS), conduct research into new satellite and sensor technologies, and manage Australia's access to satellite facilities such as NovaSAR, which is due for launch later this year.



The NovaSAR satellite will provide CSIRO and the wider Australian research community with access to an advanced form of radar technology known as S-band Synthetic Aperture Radar, or S-band SAR, which provides high-resolution images of Earth from space. Image ©Surrey Satellite Technology



Genetic diseases could be corrected by modifying our RNA

The Scripps Research Institute's chemistry professor Matthew D. Disney has developed a small-molecule-based tool that acts on RNA to selectively delete certain gene products.

The deletion tool opens the possibility of creating drugs that can be taken conveniently as pills to correct genetic diseases — by destroying toxic gene products and by chemically controlling the body's defence mechanisms. Findings have been published in the Journal of the American Chemical Society.

RNAs represent a diverse group of molecules within cells that act like the cells' labourers — reading, regulating and expressing DNA's genetic instructions. Within our cells, RNAs are constantly in motion. They assemble, they carry out their duties and then they are broken up for recycling by RNA-degrading enzymes, which are chemical scissors that cut apart other molecules. While about 2% of our genome encodes proteins, 70–80% of the genome is transcribed into RNA, potentially offering significantly more druggable targets, according to Disney. Until recently, however, most researchers considered RNAs undruggable, because of their small size and relative lack of stability. Disney's innovation tethers a drug-like molecule — one engineered to bind precisely and selectively to a specific RNA — to a common RNA-degrading enzyme. The small-molecule/enzyme complex is designed to latch onto the undesirable gene product and destroy it.

Disney named the technology RIBOTAC, short for 'ribonuclease-targeting chimeras'. To test RIBOTAC, Disney chose for his RNA-degrading enzyme RNase L, which is a critical part of the human antiviral immune response. Present in small amounts in every cell, production of RNase L typically surges on viral infection to destroy the viral RNA and overcome the illness. For the other piece of the RIBOTAC complex, its drug-like molecule, Disney chose Targaprimir-96, a molecule engineered by his lab in 2016 to bind with a microRNA oncogene known to boost cancer cell proliferation — especially in the difficult-to-treat triple-negative breast cancer miRNA-96.

Awakening the body's ability to kill its own cancer by exploiting cells' RNA degradation system offers a novel approach to attacking cancer, Disney said. He added that RIBOTAC has potentially broad applications for cancer and other gene-driven diseases as well. Disney's lab has spent many years developing a computational method called Inforna to match RNAs with adequate stability and structure to small, drug-like molecules capable of binding to them. His technique led to the development of Targaprimir-96 and multiple other disease-modifying compounds, some of which are now moving towards clinical development. "We will be laser-focused on diseases for which there are no known cure and have a poor prognosis, such as hard-to-treat cancers and incurable human genetic disease."

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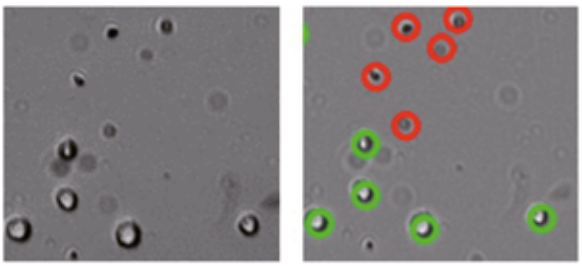

Figure 1. *Dead cells stained with Trypan blue are detected by the image analysis algorithm. Red circles represent dead cells, green circles represent live cells.*

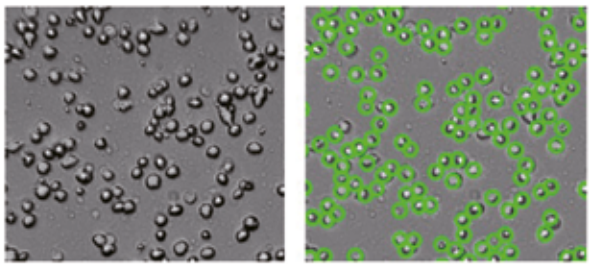

Figure 2. *The image analysis algorithm is able to detect clusters of cells. Red circles represent dead cells, green circles represent live cells.*

* *Measured using a 73 Mbps download speed and a 20 Mbps upload speed. Actual speed can vary depending on the internet connection.*

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A fresh look at microbes in the Murray River

Flinders University researchers are seeking to better understand our vital freshwater system, with the hope of improving future use and environmental management of the Murray and other rivers.

A clean bill of health for the Murray River is of vital importance for South Australia's agricultural and domestic water supply, yet most scientific examination of microbial movements in water is done in marine environments rather than freshwater river systems. With this in mind, Flinders researchers led by Dr Lisa Dann have presented a new examination of river health with a fresh look at microbial distributions from Murray River water samples.

"Despite their importance, research on freshwater systems has always lagged behind its marine counterpart, so these findings will help bridge a gap in knowledge about microbial ecology," said Dr Dann, whose work has been published in the journal *PLoS ONE*.

Microbial distributions had previously been considered homogeneous, with large-scale sampling considered representative of abundant microbial communities over smaller scales. However, it turns out this is not the case, with the Flinders researchers identifying localised areas of heightened microbial abundance ('hotspots') and depleted areas ('coldspots') only millimetres apart, capturing the scale at which individual microbes interact.

The research shows that these hotspots and coldspots are taxonomically distinct, with 1 µL samples from these hotspots containing an abundance of a single genus, which are called 'micropatches'. This reveals that strong and extensive taxonomic changes can be found across a few millilitres. As microbial hotspots and coldspots are important microenvironments for nutrient exchange and cellular interactions, understanding their taxonomic make-up will aid further understanding of environmental and microbial diversity, and ecosystem function.

"These findings will help our understanding of microbial communities within this system and hopefully aid in the future management of this river," said Dr Dann. "The findings of this paper are relevant to a variety of fields, such as industry, technology and disease research, as it demonstrates the extent to which microbial communities structure themselves."

Further research by Dr Dann is examining the way microbes invade different environments, and assessing the scale at which microbes sort themselves across subsurface groundwater systems, surface marine and freshwater environments, and the human oral microbiome.

Corneal transplant registry informs future eye surgery

An innovative vision-restoring procedure has been reported on in detail for the first time, assisting surgeons to make important decisions when using corneal grafts to treat thousands of Australians facing blindness each year.

The findings form part of the 2018 report of The Australian Corneal Graft Registry (ACGR), which collects and analyses national data relating to corneal transplants. Established at Flinders University in 1985, the registry is one of the world's largest repositories of information on corneal transplants, having collected data on more than 35,000 graft procedures and enabled many advances to be made in the field of ophthalmology.

Corneal grafting, or keratoplasty, involves the replacement of the very front clear 'window' section of the eye with a cornea from a deceased donor. Corneal damage from genetic conditions, infections or traumatic injuries is one of the major causes of blindness in Australia.

"The newer procedure, called Descemet's Membrane Endothelial Keratoplasty, involves replacing only a very thin internal layer of the cornea," said Associate Professor Richard Mills, Medical Director of the ACGR. "It requires fewer stitches and is often commended for potentially reduced rates of graft rejection and enabling final vision outcomes to be reached in a shorter time.

"However, there are aspects which can make these techniques more complex to perform. This can lead to higher rates of early failure. It is therefore important that both the short- and long-term outcomes are documented for surgeons to weigh up the pros and cons of these surgeries for patients' particular needs."

Associate Professor Mills said, "Given the immense amount of data the registry holds and its longitudinal nature — with patient outcomes analysed over decades — the reports are regarded as a vital source of information on the different types of keratoplasty performed in Australia."

The registry has played a key role in reducing the time Australians need to wait for sight-restoring transplants by overturning previous beliefs that cornea donors have to be young. Its knowledge has also led to other countries establishing registries based on the Flinders University model, and Flinders' data is often used in international comparative studies investigating improved corneal transplants.

The registry recently received a grant from the Australian Government's Organ and Tissue Authority (DonateLife) of approximately $500,000 to ensure its continued operation for the next two years.

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Mansi Gandhi

Impactful science

A Nobel prize-winning American cell biologist talks about extracellular vesicles (EVs), exciting developments in the field and the challenges facing scientific publishing.

American cell biologist Randy Wayne Schekman's fascination with microbiology started at the age of 12 with a toy microscope. Over 50 years later, Schekman, a Professor of molecular and cell biology at the University of California, Berkeley, received the Nobel Prize in Physiology or Medicine for the discoveries of machinery regulating vesicle traffic, a major transport system in our cells. He will be in Sydney to deliver the ASBMB Grimwade Keynote Plenary Lecture at this year's ComBio2018 conference to be held 23–26 September at the International Convention Centre, Sydney.

Schekman's research efforts have been focused on extracellular vesicles (EVs), which are produced by essentially all eukaryotic cells and have been shown to convey proteins, small molecule metabolites and small RNA molecules to target cells where they are taken up by endocytosis. "Once internalised, the vesicle constituents may alter the metabolism and pattern of gene expression in the target cell. My lab has devised a biochemical method to evaluate the RNA molecules that are packaged into a particular class of EVs, exosomes, and have developed a cell-free reaction that recapitulates the sorting of selected species of microRNAs that form in an incubation containing membranes and cytosol from broken cultured human cells."

Separately, Schekman has also served as the Editor-in-Chief of two international scientific journals — *The Proceedings of the National Academy of Sciences*, and for the past 7+ years, the life science journal *eLife*.

He's also Chair of an initiative on Parkinson's disease (https://parkinsonsroadmap.org/). This initiative will grow into an organisation to support research on basic disease mechanisms responsible for Parkinson's disease with the financial backing of the Sergey Brin Family Foundation.

At the upcoming ComBio conference, Schekman will talk about his team's work on how small RNA molecules are sorted into vesicles secreted by human cells. "We have discovered the role of two RNA binding proteins and two different RNA sequences that promote high fidelity sorting of microRNA molecules."

The field of biomedical science is going through an exciting phase. Commenting on three developments that stand out, Schekman said, "The ability to visualise molecules in real time by super-resolution microscopy, the ability to modify specific target genes by genome editing and the ability to unleash the power of T-cells to attack tumours." These three revolutionary developments have allowed us to see and control molecules with unprecedented precision and in the case of T-cells, to cure/control certain tumours that used to be invariably fatal.

While there are opportunities, there are also challenges. "We have never had greater power to explore the natural world and yet the understanding and acceptance of science and the scientific method is routinely attacked by ill-informed critics who place faith, dogma and politics ahead of reason. Our politicians too often embrace populism and prejudice ahead of progress on such vital issues as climate change, enhancement of food resources by the application of modern technologies such as genetic engineering and genome editing, and the international exchange of scholars around the world. Scientists must take a more active role in public education and appreciation of science and all that it has provided."

Schekman has long been an open advocate of open access. When asked about tackling the issue of perverse incentives, he said, "The Open Access (OA) movement, launched in Britain but greatly expanded by the Public Library of Science (PLoS), seeks to eliminate the firewall that separates published work from public access. OA journals are funded by a mix of page charges and philanthropic or foundation support. Most OA journals embrace a more liberal licensing agreement on the use and re-use of published work, favouring the creative commons licence rather than a copyright held by the publisher. Some publishers, particularly commercial firms, view the OA movement as a threat to the viability of their business plan. Major commercial publishers, particularly Elsevier, have fought against government mandates for OA publication of publicly funded research."

The assessment of scholarly achievement depends critically on the proper evaluation and publication of research work in scholarly journals, he said. "Investigators face a dizzying array of journal styles that include commercial, not-for-profit and academic society journals that are supported by a mix of subscription and page charges. The most selective and successful journals, *Science*, *Nature* and *Cell* (a life science journal owned by Elsevier), maintain a firm hold on the high end of the scientific literature by appealing to investigators to submit only their most important work. Typically, these journals publish only a small fraction of the papers they receive and for the most part they rely on professional editors rather than active scholars to make key editorial decisions.

"In the past, publishers such as Nature and Elsevier reinforced their high standing by relying on a metric, the journal impact factor (JIF) that computes the average number of citations of papers published in the journal during the preceding two-year period. As a consequence, many investigators, who quite naturally seek career advancement, strive to publish in these journals even at the expense of repeated cycles of review, wasteful additional experimental work and ultimately lost time. A growing number of investigators feel it is time for scholars to reassume authority for the publication of their research work and to eschew the use of JIF in the evaluation of scholarly achievement and favour OA publications over what I have called the 'luxury' journals."

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Holotomographic microscopy with 3D fluorescence imaging

The HT-2 from Tomocube combines both holotomography and 3D fluorescence imaging into one microscope. The HT-2 facilitates three-dimensional fluorescence and optical diffraction tomography of live cells using structured illumination with minimal stress on cells. This technology is said to open the door to a variety of previously unexplored applications in the fields of bioscience and life science, helping researchers and clinicians better understand, diagnose and treat disease.

The HT-2 is able to achieve label-free imaging of cells and allows users to conduct long-term tracking of specific areas within live cells. It has the capacity to deliver correlative analysis in 2D, 3D and 4D with HT and fluorescence images, and incorporates a customisable three-channel LED light source (385, 470 and 570 nm). HT-2 generates Z-stack images with a motorised Z-drive (step resolution: 150 nm).

The product offers correlative microscopy in one instrument, providing high-quality 3D images of both holotomography and 3D fluorescence for each sample. Quantitative data is marked with fluorescence — the HT-2 provides morphological (volume, surface area, projection area, sphericity and ellipticity), chemical (dry mass and concentration) and mechanical (cell deformability) properties of cells with a 3D refractive index (RI) tomogram. Fluorescence imaging provides information about molecular specificity.

The simultaneous measurement capability of time-lapse 3D RI tomography and fluorescence imaging allows long-time tracking of specific targets in live cells. The fluorescence image provides the position of specific target organelles or structures in live cells, and consecutive measurements of time-lapse 3D RI tomography enable the monitoring of cells and their structures with minimal stress.

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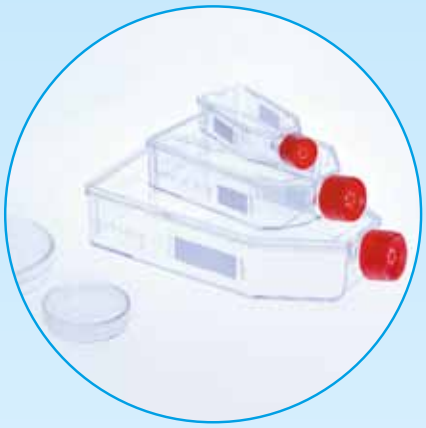

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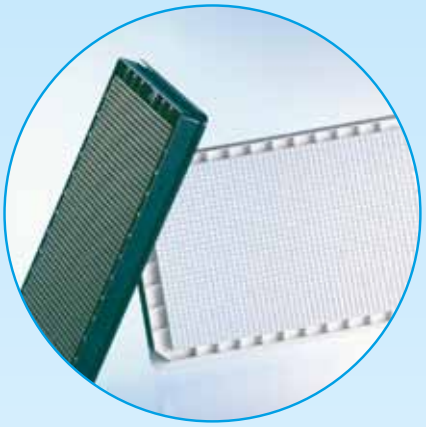
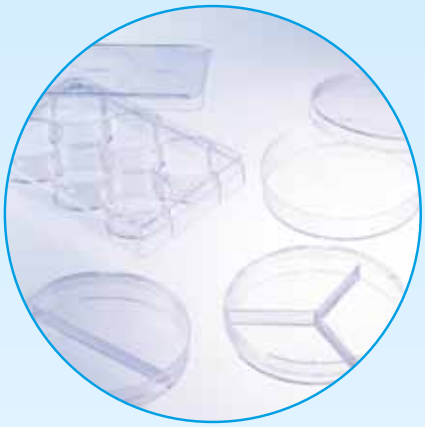


Microbiology



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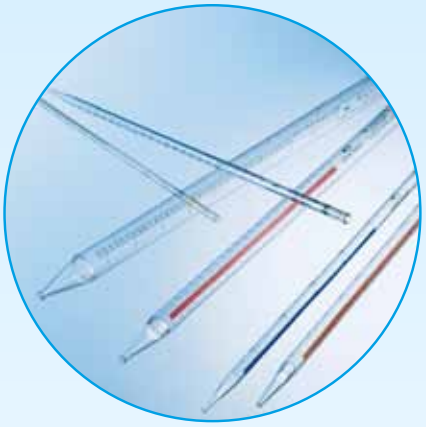
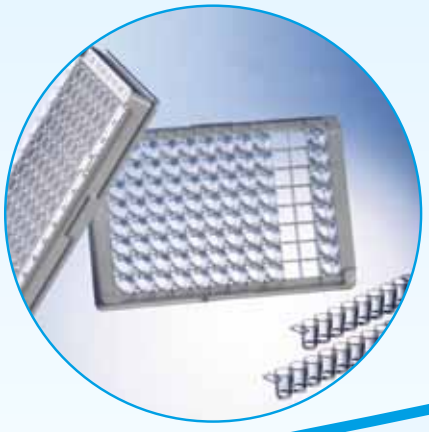
Liquid Handling



Upscaled Cell Culture

Immunology



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Desktop SEM

Although many laboratories still use optical microscopy for general inspection purposes, scanning electron microscopes can provide much higher image resolution and magnification to describe surface topography and composition. Large SEMs typically found in university microscopy centres can require intensive operator training. The Phenom ProX desktop scanning electron microscope (SEM) offers an alternative, providing a fast, easy-to-use desktop SEM system to rapidly study the external shape and composition of an object.

The 5th generation ProX SEM is the latest addition to the Phenom series and offers fast, high-resolution imaging (up to 150,000x magnification) and fast sample loading (<30 s) with ease of use. Unlike other systems, the desktop Phenom ProX has fully integrated X-ray analysis (energy dispersive spectrometer, EDS) that allows the user to quickly identify and assess the distribution of elements in a sample. The long-life CeB6 electron source, in combination with two detectors — the four-segment backscatter detector (BSD) for chemical contrast information and the secondary electron detector (SED) for surface sensitive imaging — supports high-resolution imaging (<8 nm) to yield sharp images.

The product can help to expand capabilities for a wide range of applications. When combined with the programming interface (PPI) automation script, the SEM can be used to study the coverage of phosphate coatings and crystal morphology on metallic objects. Vacuum-sensitive and vulnerable samples such as biological, food or organic coatings can be studied using the temperature-controlled sample holder.

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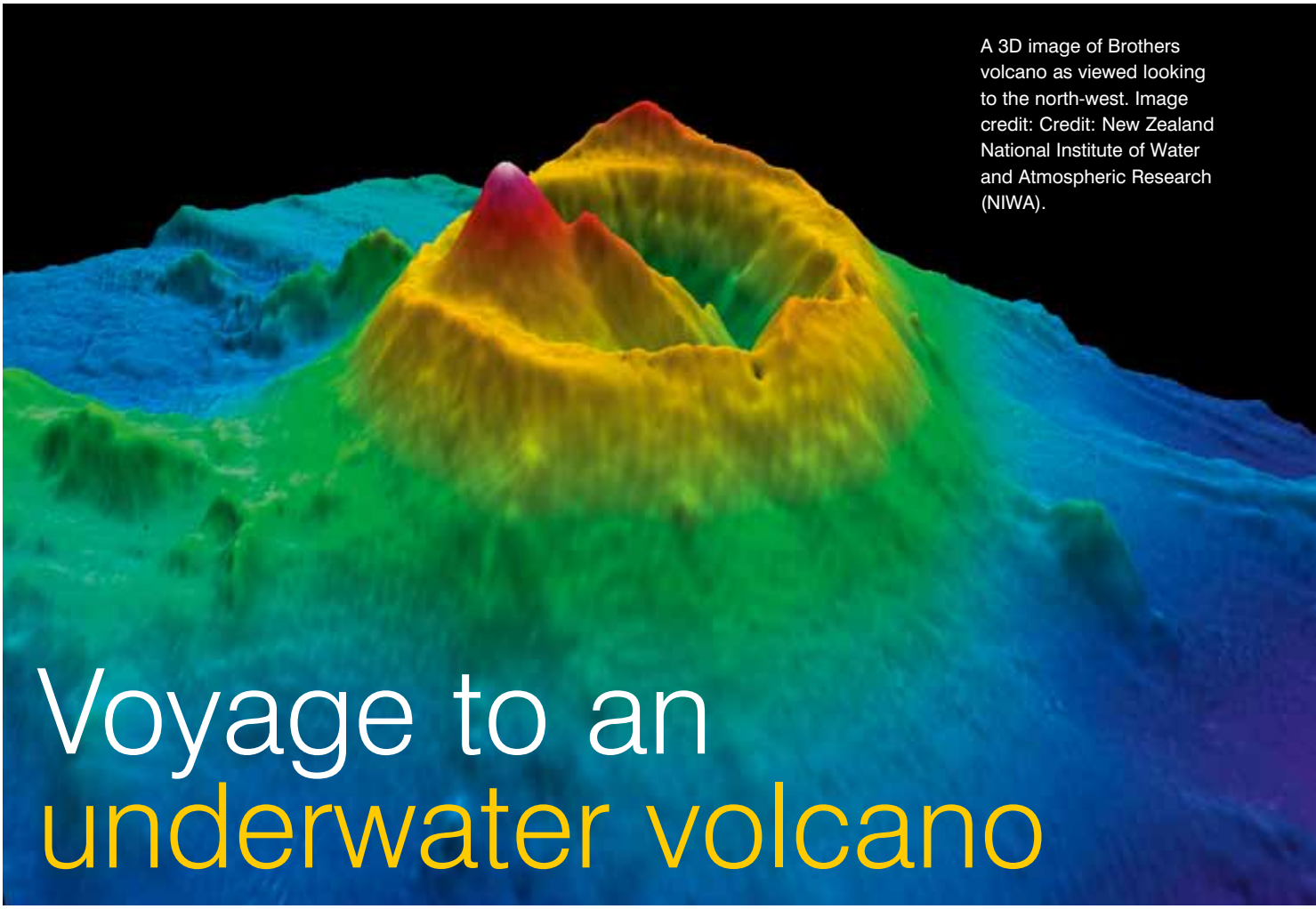
Lauren Davis



A 3D image of Brothers volcano as viewed looking to the north-west. Image credit: Credit: New Zealand National Institute of Water and Atmospheric Research (NIWA).

Voyage to an underwater volcano

An international team of scientists have returned from a once-in-a-lifetime expedition that took them 400 km north-east of New Zealand on the research vessel ***JOIDES Resolution***. The goal of their two-month voyage? To drill into an active underwater volcano.

One of the 30 scientists on board was Dr Dominique Tanner, an igneous petrologist from the University of Wollongong's School of Earth and Environmental Sciences. She applied for Expedition 376 at the beginning of 2017 and was lucky enough to be selected as the Australian representative.

"I wanted to be part of this expedition over any other because I'm really interested in subvolcanic processes that concentrate precious metals beneath volcanoes, and this is one of the rare opportunities we have to look into an environment that's actively concentrating metals," Dr Tanner told *Lab+Life Scientist*.

Specifically, Dr Tanner and her colleagues would be studying the Brothers volcano — one of a 1250 km-long chain of seafloor volcanoes known as the Kermadec Arc, above the active subduction zone where the Pacific tectonic plate subducts beneath the Australian plate. Measuring 13 km long and 8 km wide, Brothers is the most hydrothermally active of any of the volcanoes in the region.

"It's also somewhat unique because it's what we call a caldera — a big O-shaped volcano, where essentially the top's been blown off it," Dr Tanner said. "Because it's so hydrothermally active, it's the obvious target for trying to understand the subvolcanic processes controlling fluxes of metals, but also potentially fostering life in these extreme environments.

"I'm personally interested in the minerals and the mineral chemistry from the volcano, but there were many other different scientists on board, and some of them were microbiologists, so they were interested in looking at the limits where we find life in these settings. So there's a range of different research questions that people are asking about this volcano."

Of course none of these questions could be answered without taking samples from the volcano, and that's where the *JOIDES Resolution* comes in. Doubling as a drilling boat, the vessel is renowned for its derrick — an imposing tower that extends over 57 m above the water line. From

here, a drill string was lowered into the water, through 1.3 km of ocean, until it reached the surface of the volcano.

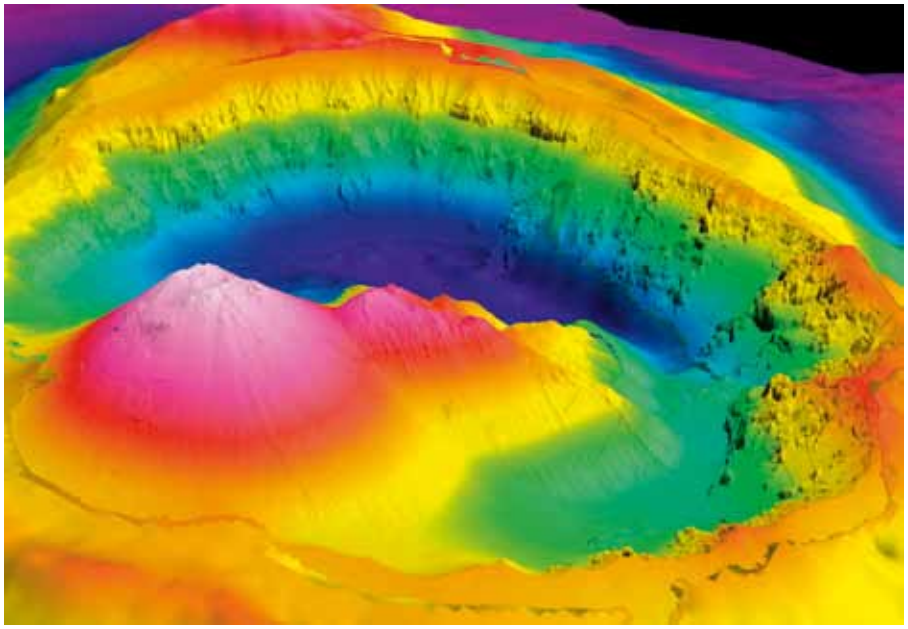
"The equipment we're using is not specifically designed for drilling into hydrothermal systems or loose volcanic rocks," Dr Tanner said. "But the expedition exceeded all my expectations on how well this equipment would perform once we were at the volcano, and we ended up recovering more core than any other expedition that had drilled into a volcanic hydrothermal setting."

Once the team had drilled holes a couple of hundred metres beneath the surface of the volcano, the resulting material — collected in core barrels measuring 4.5 to 9 m — was recovered for examination in the vessel's core laboratory, which Dr Tanner described as "state of the art".

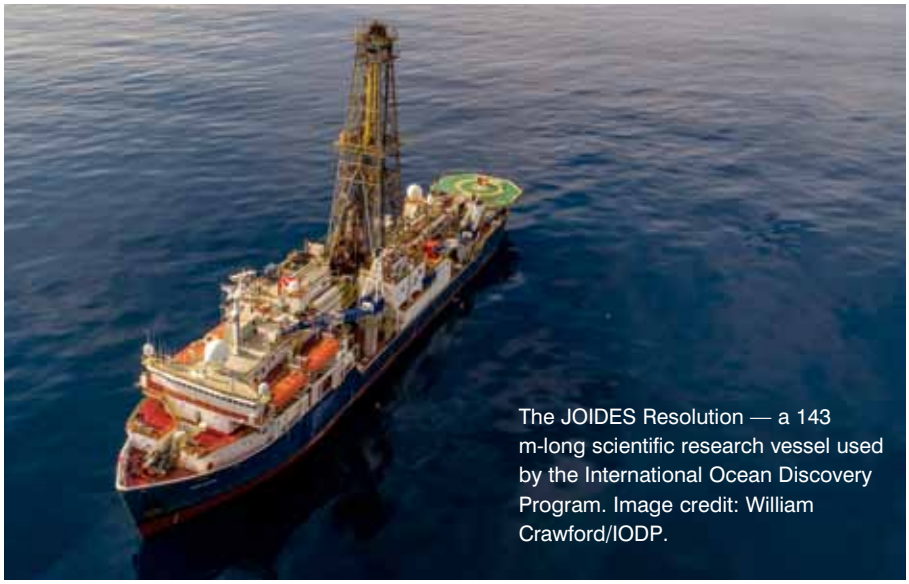
"We had a range of geophysical equipment on board where we looked at things like natural gamma ray radiation and seismic wave velocities; we could quantify the colours of rocks by running different spectrometers along the core; we could measure the magnetic susceptibility of the core; we had a paleomagnetist on board who was analysing the cores as they were collected; and then we also had geochemical labs on board," she said. "We had a working inductively coupled plasma optical emission spectrometer (ICP-OES) and gas chromatograph, so we could analyse the composition of the material we were drilling, down to the parts-per-million level for some trace elements."

As a geologist, Dr Tanner spent most of her time in the vessel's thin section laboratory, where she used a petrological microscope to determine the mineralogy of the samples. She explained, "What we do is we can insert one or two polarising filters into the microscope, and we can look at the way that light passes through different thin slices of rock, as this will split light into different colours — into a full rainbow spectrum. Each mineral has a distinctive colour on that spectrum once the light has passed through a polarising filter, which enables us to identify the minerals present in each sample."

Dr Tanner determines the mineralogy of an altered volcanic rock using a petrographic microscope. Image credit: William Crawford/IODP.



Brothers Volcano as viewed looking into the caldera from the south. Image credit: New Zealand American Submarine Ring of Fire 2007 Exploration, NOAA Vents Program; Institute of Geological & Nuclear Sciences and NOAA-OE.



The JOIDES Resolution — a 143 m-long scientific research vessel used by the International Ocean Discovery Program. Image credit: William Crawford/IODP.

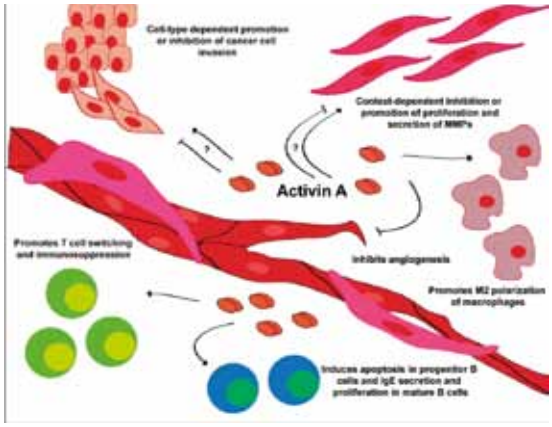
Now back on dry land, Dr Tanner is looking forward to conducting further examination of her samples — particularly looking at the chemistry of quartz and opal, which are common minerals in the Earth's crust.

"What I'm interested in is studying the trace element chemistry of these really common minerals, because they precipitate from hot fluids beneath the volcano," she said. "And I want to see if the chemistry changes in different types of volcanic hydrothermal settings. Do the trace elements in silica minerals record a different fluid chemistry if one fluid has a greater magmatic input than another?

"The reason for doing this is so then we can go back to the volcanic deposits and subvolcanic deposits on land — for instance, copper and gold mineral deposits — and we can try and infer more about the fluids that would have formed them, by comparing them as an analogue to this active hydrothermal setting."

Dr Tanner's participation on the science program Expedition 376 has been enabled by the International Ocean Discovery Program (IODP) and the Australian and New Zealand IODP Consortium (ANZIC). ANZIC is supported by the Australian Government through the Australian Research Council's LIEF funding scheme and the Australian and New Zealand consortium of universities and government agencies.

Recombinant human Activin A



Xeno-free Recombinant Human Activin A from HumanZyme is a member of the TGF beta super-family, expressed from human 293 cells as a disulfide-linked non-glycolsylated homodimer with an apparent molecular mass of 25 kDa. The cytokine is produced in a serum-free, chemically defined media.

Available in a range of pack sizes from 2 to 1000 ug, the product is lyophilised and carrier-free. It is also free of endotoxins and animal-derived products.

Other technical specifications are as follows: typically ≤5 ng/mL EC50; purity >95%; formulation 1x PBS.

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Q-TOF system

Mass spectrometry company Shimadzu has announced the launch of the quadrupole time-of-flight (Q-TOF) LCMS-9030 system.

The Shimadzu LCMS-9030 is a research-grade mass spectrometer designed to deliver high-resolution, accurate-mass detection with fast data acquisition rates, allowing scientists to identify and quantify more compounds with confidence. It utilises the same engineering DNA as the company's rugged, high-performance triple quadrupole (LC-MS/MS) platform and integrates that with powerful TOF architecture to transform high mass accuracy workflows by achieving high-sensitivity, high-speed, high-resolution detection.

Ultrafast (UF) acquisition rates and core ion beam technologies developed for the triple quadrupole platform have delivered high sensitivity, specific quantitation and enhanced target compound verification. The LCMS-9030 Q-TOF builds on this platform by rethinking time-of-flight detection. Core ion beam technologies enable a special approach to ion gating using UFaccumulation to create a precise pulse of ions into the flight tube optimised for high sensitivity and high resolution using iRefTOF reflectron technology. The iRefTOF generates a reflectron field, delivering high resolution for the flight path with stable mass accuracy.

The Q-TOF technology on the LCMS-9030 is designed to make an impact across all applications — from small molecule quantitation to complex intact protein analysis.

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Electrochemiluminescence detection instrument

The MESO QuickPlex SQ 120 instrument has increased the accessibility of researchers and scientists to Meso Scale Discovery's (MSD) multi-array technology, a proprietary combination of patterned arrays and electrochemiluminescence detection that results in high sensitivity, speed, dynamic range and convenience.

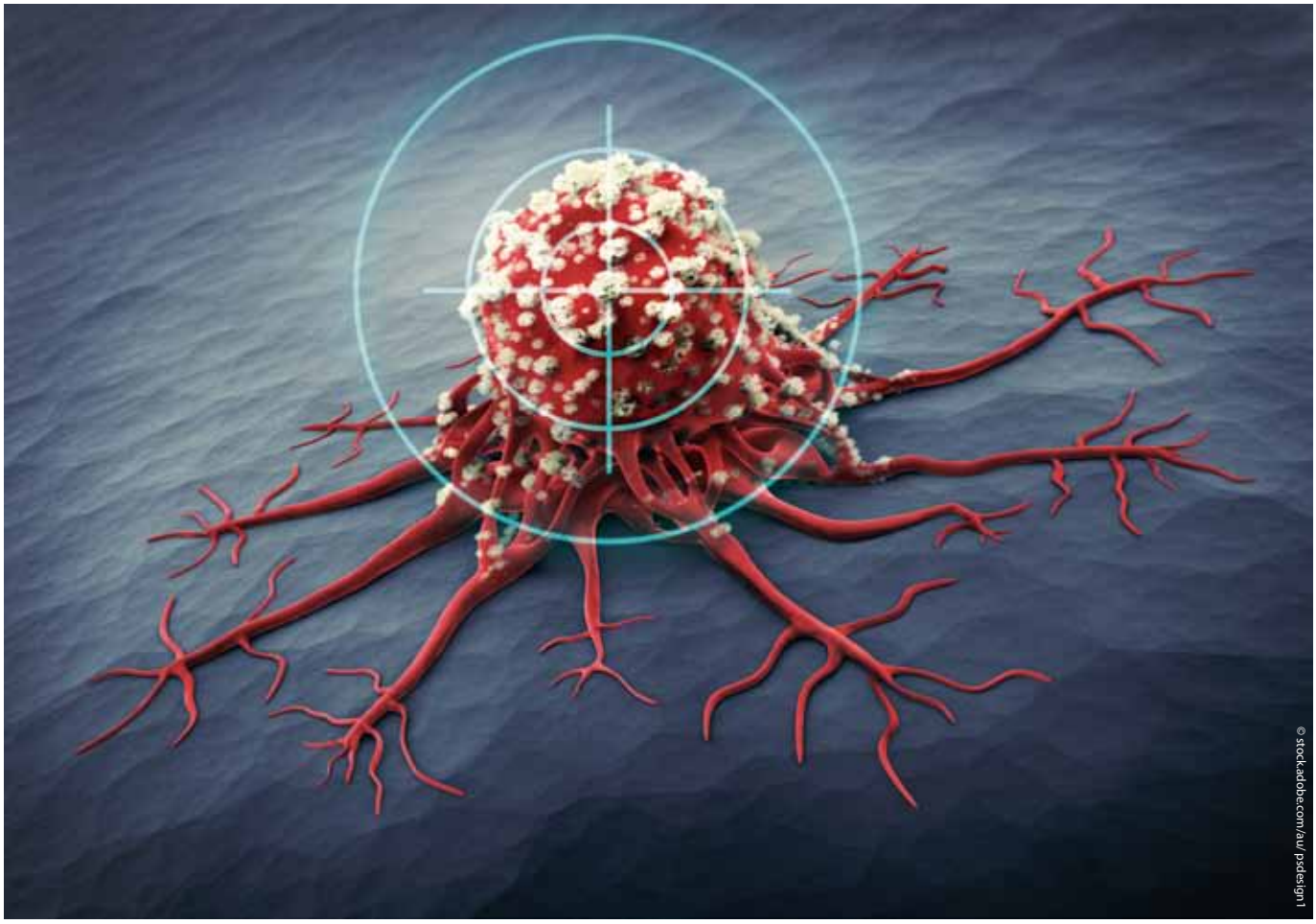
One of the fastest growing technologies in the immunoassay field, electrochemiluminescence (ECL) is driving research in areas including neurobiology/neurodegeneration, immunogenicity and intracellular signalling. The SQ 120 provides high sensitivity and dynamic range, simple protocols, rapid and continuous reads and fast, well-organised results via Discovery Workbench assay analysis software. The instrument requires no user calibration or maintenance, no complicated fluidics and no between-read cleaning.

MSD MULTI-ARRAY plates are available as single-spot (single-assay) plates and as MULTI-SPOT plates with patterned spot arrays in each well. MULTI-SPOT plates measure multiple analytes simultaneously in a single well, increasing throughput and enabling novel assay panels. The instrument has a wide menu of commercially available assay kits and a full line of components and reagents for developing in-house assays.

Exclusively available for use with the MSD instruments, V-PLEX validated immunoassays deliver reproducible results to support demanding long-term studies. The extensive menu of over 100 assay kits provides many options for the conscientious researcher who is looking for increased sensitivity and dynamic range, as well as lot-to-lot consistency over the life of their longitudinal study.

Whether multiplexing biomarker and cytokine assays, testing for immunogenicity or toxicity or developing assays, users will appreciate the fast, simple assay processing, low sample volume requirements and minimal consumption of reagents that the instrument make possible.

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



How a magnetised wire attracts tumour cells

Stanford scientists have used a magnetic wire to capture free-floating tumour cells in the blood.

The technique, which has only been used in pigs so far, is claimed to attract from 10–80 times more tumour cells than current blood-based cancer-detection methods, making it a potent tool to catch the disease earlier.

The wire, which is threaded into a vein, attracts special magnetic nanoparticles engineered to glom onto tumour cells that may be roaming the bloodstream if you have a tumour somewhere in your body. With these tumour cells essentially magnetised, the wire can lure the cells out of the free-flowing bloodstream using the same force that holds family photos to your refrigerator.

Sanjiv "Sam" Gambhir, MD, PhD, professor and chair of radiology and director of the Canary Center at Stanford for Cancer Early Detection, developed the wire with the help of his colleagues. "It could be useful in any other disease in which there are cells or molecules of interest in the blood," said Gambhir. "For example, let's say you're checking for a bacterial infection, circulating tumour DNA or rare cells that are responsible for inflammation — in any of these scenarios, the wire and nanoparticles help to enrich the signal, and therefore detect the disease or infection."

The study was published in *Nature Biomedical Engineering*. Gambhir is the senior author. Postdoctoral scholar Ophir Vermesh, MD, PhD; surgery resident Tianjia Jessie Ge, MD; and MD-PhD student Amin Aalipour share lead authorship.

No vial of blood necessary

Cells that have sloughed off the tumour and cruise the bloodstream freely, otherwise known as circulating tumour cells, can serve as cancer biomarkers, signalling the presence of the disease.

"These circulating tumour cells are so few that if you just take a regular blood sample, those test tubes likely won't even have a single circulating tumour cell in them," said Gambhir, the Virginia and D.K. Ludwig Professor of Clinical Investigation in Cancer Research. It would be like searching for a grain of sand in a bathtub, but only scooping out a few cups of water.

That is where the magnetic wire can make a difference, according to Gambhir. For the wire, which is about the length of the little finger and the thickness of a paperclip, to work, circulating tumour cells must be effectively magnetised with nanoparticles. The nanoparticles contain an antibody that latches onto circulating tumour cells. Once the floating tumour cell and nanoparticle are hitched, the cell lugs the tiny magnet around with it, and when the cell-magnet complex flows past the wire, it's compelled by magnetic force to veer from its regular path in the bloodstream and stick to the wire. Then, the wire is removed from the vein and the cells are stripped for analysis.

Gambhir and his team have yet to try out the wire in people, as they still have to file for approval from the Food and Drug Administration, but they have successfully tested it in pigs, placing the device in a vein near the pig's ear. That vein is fairly similar to veins in the human arm.

"We estimate that it would take about 80 tubes of blood to match what the wire is able to sample in 20 minutes," Gambhir said. Of course, he continued, it's not practical to remove 80 test tubes of blood from one person; that's more than a half-litre. "So, we're hoping this approach will enrich our detection capability and give us better insight into just how rare these circulating tumour cells are, and how early on they exist once the cancer is present."

If approved for use in humans, the magnetic wire (depicted in gray) would be inserted into a vein in the arm (in light pink) and attract floating cancer cells labeled with magnetic nanoparticles (light green and gray) that have come from the tumour (neon green). Courtesy of Sam Gambhir

A flexible wire

Gambhir said the technique could also be used to gather genetic information about tumours located in hard-to-biopsy places or to provide information about the efficacy of a cancer treatment. Perhaps most intriguingly, the magnetic wire may even stand to evolve into a treatment in and of itself.

It could be useful in any other disease in which there are cells or molecules of interest in the blood. Now, Gambhir is working to ready the technique for humans, which involves approval for the nanoparticles. His lab is conducting toxicity studies in mice, paying close attention to what happens to leftover nanoparticles that don't bind. So far, there are no signs of toxicity, and the extras decay over the course of a few weeks, he said. Gambhir is also looking into nanoparticles that are already FDA-approved, working to tweak them for use with the wire. Once approved for humans, the goal is to develop the technology into a multipronged tool that will boost detection, diagnosis, treatment and evaluation of cancer therapy.

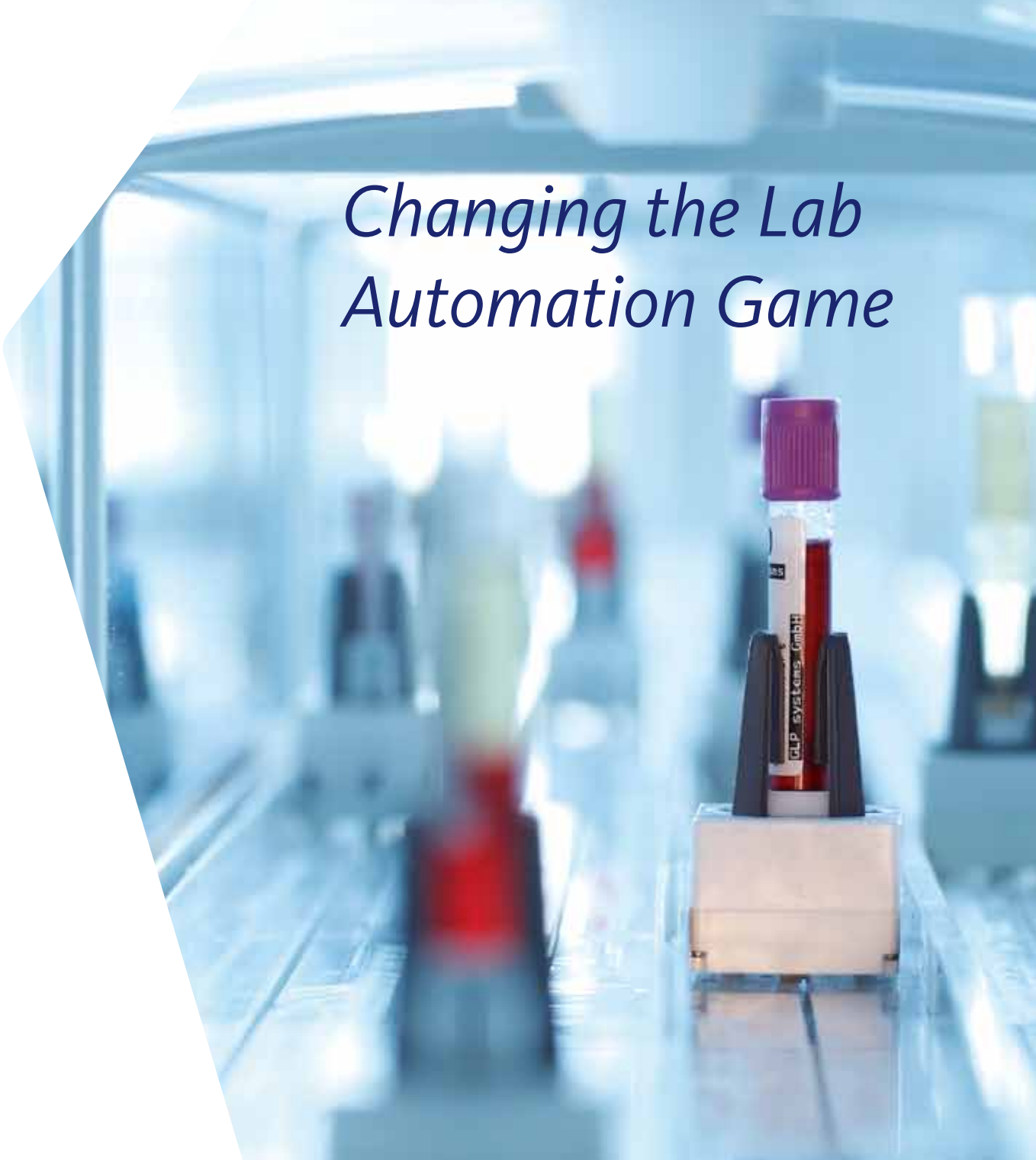
The study's other Stanford authors are veterinary research coordinator Yamil Saenz, DVM; former graduate students Chin Chun Ooi, PhD, and Yue Guo, PhD; radiology and molecular imaging scientist Israt Alam, PhD; senior research scientist Seung-min Park, PhD; graduate student Charlie Adelson; postdoctoral scholars Hamed Arami, PhD, and Yoshiaki Mitsutake, PhD; assistant professor of comparative medicine Jose Vilches-Moure, DVM, PhD; life science technician Elias Godoy; research scientist Michael Bachmann, MD, ScD; preclinical laboratory managing director Jennifer Lyons; instructor of radiology Kerstin Mueller, PhD; life science technician Alfredo Green; Shan Wang, PhD, professor of materials science and engineering and of electrical engineering; and chemistry professor Edward Solomon, PhD, who is also a professor of photon science at SLAC National Accelerator Laboratory.

Gambhir is a member of Stanford Bio-X, the Stanford Cancer Institute, the Stanford Cardiovascular Institute and the Stanford Neurosciences Institute.

The study was funded by the National Institutes of Health (grants U54CA151459, R21CA185804 and S10 RR026714), the Canary Foundation and the Ben and Catherine Ivy Foundation.

Stanford's Department of Radiology also supported the work.

Changing the Lab Automation Game



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Microbial genetic identification

Microbial identification via genetic sequencing is useful for helping to provide identification for unknown isolates that are found to be present in critical areas in an aseptic setting. This is vital for both investigation purposes and regulatory requirement.

Genomic DNA is extracted directly from dead or alive bacterial colonies grown under any conditions. The 16S rRNA gene is amplified using universal primers and thermalcyclers. The amplified 16S rRNA gene product is sequenced using dye terminator cycle sequencing chemistry. The sequence reactions are analysed using automated DNA sequencers and software.

Unknown bacteria samples are identified using microbial identification software and compared against the Eurofins IDmyk Comparative Sequence Index database containing over 8470 entries. Routine bacterial identification is performed (by default) using the long sequence (1200–1400 base pairs) of the rDNA. The longer sequence allows for better discrimination of closely related species and therefore gives higher confidence in the results provided.

Data analysis can be done using either automated or manual modes. Outcome predictions are done using the phylogenetic tree tool. The system also has the ability to build user-defined and user-validated custom libraries.

With 8470 valid bacteria type strain entries, the Eurofins IDmyk Comparative Sequence Index database, which is proprietary to Eurofins, is said to be the largest database in the world. The Eurofins IDmyk fungal database (1650 species) complements the bacterial library.

Eurofins | ams
www.eurofins.com.au/biopharma-services

CO_2 incubator

The EuroClone S@feGrow Pro is a high-performance, high-quality CO_2 incubator that is equipped with an 'on demand' decontamination cycle and designed to provide a suitable environment for cell and tissue culture, taking into consideration the most stringent needs of cell biologists and fastidious cell lines.

The S@feGrow Pro maintains the CO_2 gas level, uniform temperature and a consistently high level of humidity for a stable and uniform culturing environment, even for most critical applications like IVF or stem cell cultures.

The product features 188 L of internal space, with a large usable surface area of 0.23 m^2 per shelf. It is deigned to maintain precise and correct temperature control.

The incubator maintains CO_2 percentage with a state-of-the-art controller with solid-state IR sensor with auto zeroing of CO_2. This offers good CO_2 control and recovery independent from humidity level, unlike TC type sensors.

The unit has a fanless design with gentle air movement by thermal convection, reducing contamination risk and simplifying cleaning. It has a seamless internal electropolished stainless steel construction with fully rounded corners, results in easy and efficient cleaning, corrosion resistance and further reduction of contamination risk.

The incubator comes with a removable humidity water pan that is easy to fill and keep clean. Its solid stainless steel shelves help contain minor spills and assist with even heating of cultures.

It has a fully automatic validated 125°C direct heat decontamination cycle, with no need to remove any incubator parts or fixtures prior to cycle.

LAF Technologies Pty Ltd
www.laftech.com.au

Overhead stirrers

IKA's overhead stirrer technology is designed to optimise complex stirring applications. The EUROSTAR digital series features a digital speed display and overload protection.

The universal laboratory stirrer is designed for simple stirring tasks for quantities up to 100 L (H_2O). It automatically adjusts the speed through microprocessor-controlled technology within the speed range. Safety circuits ensure automatic cut-off in anti-stall or overload conditions.

Continuous comparison of shaft speed to desired speed is maintained and variations are adjusted automatically. This ensures a constant speed even with changes in viscosities of the sample.

Labtek currently stocks a range of the EUROSTAR overhead stirrers for immediate dispatch.

Labtek
www.labtek.com.au

Laboratory automation system

In today's competitive environment, clinical laboratories are constantly seeking solutions that will help them process an increasing number of samples tubes. Sysmex and the GLP system can provide a solution to meet today's highly demanding laboratory objectives.

The solution is specifically built to streamline laboratory workflows and develop intelligent solutions in the area of pre-analytical, analytical and post-analytical processes. Based on three core characteristics — freedom, simplicity and excellence — users can choose and manage their laboratory requirements as they require.

The GLP system handles tubes for analysis individually, using the distinctive concept of cars with no belt transport syste no racks. This is said to improve analytic routing optior shorten turnaround time. There are also fewer sources of er a reduction in time-consuming maintenance.

The system's infrastructure is lightweight and works on a m concept, providing the flexibility to customise a solution spe the needs of each user's laboratory. The GLP system is als to provide connectivity across various analysers and sections lab such as chemistry, immunology, coagulation and haema

The company's specialists carefully study the workflow in the laboratory, examining where excessive time and costs are in and design a flexible automated system suitable for the labo

Sysmex Australia Pty Ltd
www.sysmex.com.au

Thermal analyser

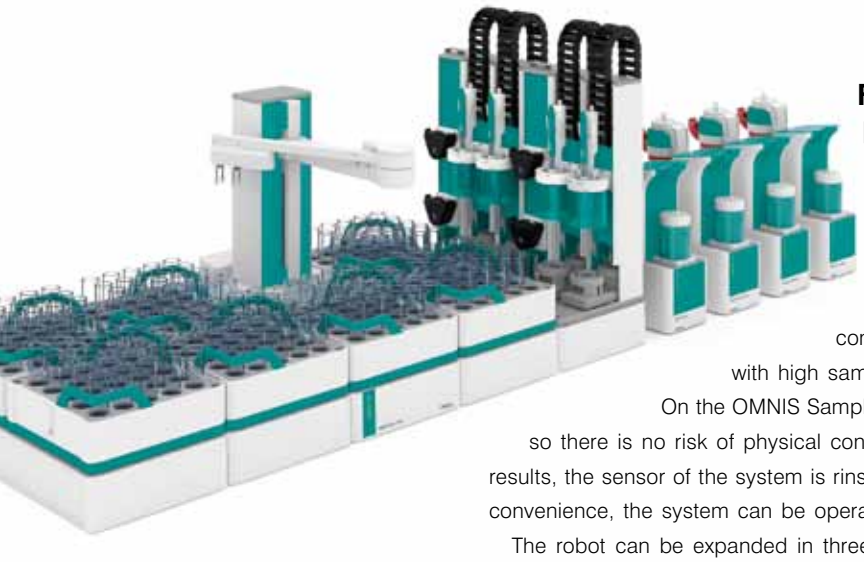
The TA Instruments Discovery DMA 850 is the latest addition to the Discovery Thermal Analysis suite, a group of high-performance material characterisation instruments.

It is a dynamic mechanical analyser to measure mechanical properties as a function of temperature, time and mechanical conditions. Key measurements include glass transition temperatures, dynamic modulus and quantification of damping characteristics. The instrument is also capable of traditional mechanical experiments such as creep and programmed loading.

A low-friction drive system and optical encoder combine to provide the best force sensitivity and displacement resolution available. The instrument exceeds existing DMA technology with advances in strain control including the new DirectStrain capability, the ability to program more elaborate mechanical conditioning and testing sequences, and an estimated 80% reduction in calibration time.

Combined with a complete selection of sample clamps, it is designed to accurately characterise a wide range of materials under relevant conditions. A selection of high-accuracy environmental systems manufactured by TA extends that capability to include control of temperature, relative humidity and measurements when the sample is immersed in a fluid. The DMA 850 is supported by TA's Air Chiller Systems that provide temperature control to -100°C without the hassle or expense of liquid nitrogen.

TA Instruments
www.tainstruments.com



Fully automated TAN/TBN titration in petrochemical samples

Metrohm presents a fully automated solution for the determination of total acid number (TAN) and total base number (TBN) in up to 112 samples. The process is based on the OMNIS Sample Robot and addresses the needs of QC laboratories in the petrochemical industry as well as contract laboratories looking for an efficient solution to cope with high sample loads.

On the OMNIS Sample Robot, the entire analysis is performed in a closed system, so there is no risk of physical contact with solvents or reagents at any time. For reproducible results, the sensor of the system is rinsed and conditioned after each determination. For safety and convenience, the system can be operated in any standard size fume hood.

The robot can be expanded in three steps from size S to M to L, which accommodates up to 112 samples evenly distributed over seven racks. The product is flexible: racks with urgent samples can be prioritised and placed on the Sample Robot while the system keeps analysing.

Maximum throughput on the robot is achieved using the possibility to perform up to four titrations in parallel at four workstations, saving up to 60% in time compared to titration at a single work station.

Metrohm Australia Pty Ltd
metrohm.com.au

Mansi Gandhi

Stomatal development

Plant biologist Professor Keiko Torii* will present the Annals of Botany Lecture at ComBio2018, a major Australian Society for Biochemistry and Molecular Biology (ASBMB) conference, held each year in association with other organisations. Here, she talks about stomatal development and the future of plant science.

Like many young biology students, Professor Keiko Torii was originally interested in medical sciences. However, the developments of plant genetic tools that became available when she was starting her undergraduate thesis in the 1980s drew her to plant sciences.

At the time, not much was known about the key genes and regulatory pathways underlying plant hormone signalling, leaf and flower development, etc, said Torii, who envisioned a bright future ahead for plant sciences. "I thought that we really need to learn about plants more; they are supporting our life and civilisation, yet we really don't know much of their developmental mechanisms and, of course, their hidden beauty."

Research focus

Torii currently runs two laboratories, one in the US (Howard Hughes Medical Institute, University of Washington) and the other in Japan (WPI-ITbM, Nagoya University). Her research focus has been, and will continue to be, on understanding the signalling in plant development, more specifically, decision-making processes in plant cellular and tissue patterning. "Research in both laboratories echoes this central theme, yet using different approaches. My HHMI/UW lab focuses on understanding the cell-cell interactions and transcriptional program specifying plasticity, commitment and differentiation of stomatal precursor cells.

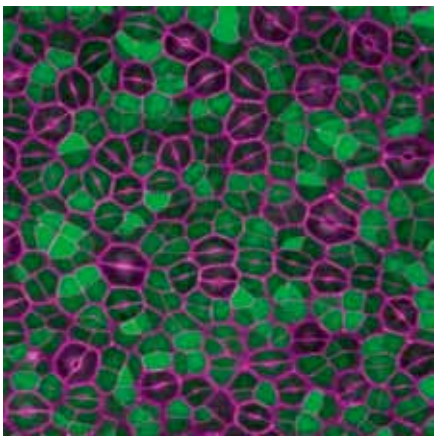
"Stomata are microscopic valves on the land plant epidermis critical for carbon fixation and water control. Plants use complex peptide signalling that leads to the decision-making process of which cells to become a stomatal precursor and when to differentiate, said Torii." For the next 12–24 months, the Torii lab would like to advance live imaging techniques to visualise this process.

In 2013, Torii started running a lab in the new cross-disciplinary synthetic chemistry institute called Institute of Transformative Biomolecules (ITbM) in Japan. Her research ITbM is focused on creating a game-changing molecule to tackle remaining problems in plant signalling. "I am truly excited that, through collaboration with synthetic chemists, we were able to design and engineer artificial, orthogonal plant hormone-receptor pair and bi-functional ligands. We are currently applying our technologies from a model plant to crop species."

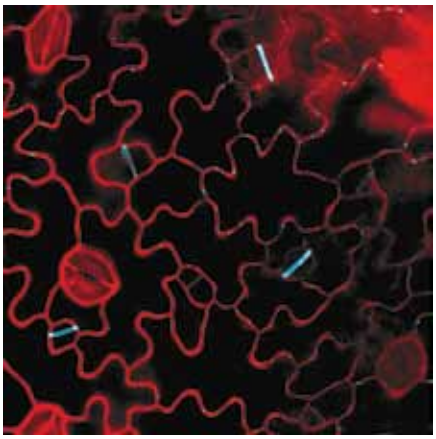
To be or not be stomata

Keiko Torii is visiting Australia for the first time to attend the ComBio conference to be held at the International Convention Centre from 23–26 September. Torii will deliver the Annals of Botany Lecture at the conference and is also excited to meet other plant scientists and cell and developmental biologists during her visit. "I am planning to talk about our latest discoveries on the decision-making process for plant cells to be or not to be stomata. I am fortunate to give one short talk about a family of peptide hormones controlling diverse aspects of plant development."

Developing inflorescence of Arabidopsis epf14 epf16 rescued by EPFL6



Stomatal-precursor expression of GFP in mute/+scrm-D mutant epidermis



Cross-disciplinary approaches

Cross-disciplinary, integrated approaches with physics, chemistry and computer science are the key to transforming the future of plant science, according to Torii. "If we are to understand how a plant responds to climate change, for instance, new insights could be drawn from integrated analysis of signal transduction, cellular response (from single cell genome dynamics, transcriptomics to post translational modifications), to whole plant physiology."

Professor Keiko Torii with members of Torii Lab.

Predictive modelling and phenotyping at diverse scales are needed, according to Torii. How to integrate overwhelming data collectively to understand how plants respond to their environment to adjust their development is still an exciting ongoing challenge, she said. Personally, I love the innovative chemical tools that enable us to visualise, probe and manipulate plant cellular response in real time, said Torii. "I strongly believe that collaboration with chemists, synthetic biologists, physicists and engineers (who develop new microscope platforms) are all important for transforming the future of plant sciences."

Plant breeding

Modern tools, such as CRISPR/Cas9, are making it possible to edit the genome DNA with speed and precision for crop plant improvements. "It is very disheartening, however, that we plant scientists are failing to convince the general public and policymakers about the importance and safety of the modern plant breeding techniques, including GMOs.

Torii is always thinking of ways to better share the excitement and importance of plant biology research. Advocating for evidence-based decision-making is a critical challenge for all scientific disciplines, according to Torii.

Keiko Torii's Annals of Botany Lecture will be delivered on Monday, 24 September. To register, please visit: www.combio.org.au/combio2018/registration.html.

*Professor Keiko Torii, Investigator, Howard Hughes Medical Institute, and Endowed Professor of Biology at the Department of Biology, University of Washington in Seattle, USA. She also serves as Overseas Principal Investigator (since 2013) of the Institute of Transformative Biomolecules (WPI-ITbM), Nagoya University, Japan. Keiko Torii received BS, MS and PhD from University of Tsukuba, Japan. She has been at the University of Washington since 2000, where she takes an integrated approach to unravel the underlying principles of cell-cell interactions specifying fate decisions and developmental patterning in plants, with specific focus on stomatal development. Her group in WPI-ITbM harnesses synthetic chemistry to probe and manipulate signalling in plant development. Torii has received numerous recognitions, including the Elected Fellow of AAAS (2012), Elected member of the Washington State Academy of Sciences (2012), ASPB Fellows Award (2015), and most notably, the Saruhashi Prize (2015), which honours a Japanese female scientist each year for both scientific accomplishments and mentoring junior women scientists to break through obstacles.

Single-use liposome extrusion device

T&T Scientific has created the NanoSizer Liposome Mini Extruder, a single-use liposome extrusion device that simplifies the process of preparing liposomes for research laboratories, manufacturing facilities and clinical settings.

The extruder enables rapid extrusion of liposomes, polymerosomes, cell membranes and colloidal suspensions. It can be used in general nanoparticle sizing and filtration applications. Each extruder contains a single, clean, track-etched polycarbonate membrane. The single-use feature enables contamination-free liposome extrusion without the need for cleaning.

The Complete NanoSizer Extrusion Kit includes everything the user needs to get started: one heat block and robust platform for extrusion; 10 NanoSizer extruders with pore size of choice; 20 sterilised single-use extrusion syringes; 20 single-use extrusion needles; and one liquid-in-glass thermometer.

Sapphire Bioscience
www.sapphirebioscience.com

Fluorescent secondary antibodies

Bio-Rad Laboratories has announced the StarBright Blue 520 Fluorescent Secondary Antibodies — fluorescent dye-labelled secondary antibodies for use in multiplex western blotting. They are said to exhibit a two- to threefold lower limit of detection than traditional green emission fluorophore-labelled antibodies such as Alexa Fluor 488 or DyLight 488, the current industry standards.

Bio-Rad created the StarBright Blue line of secondary antibodies to enable sensitive fluorescent detection, short exposure times and easy multiplexing for western blotting. The plug-and-play antibodies allow simultaneous detection of up to three proteins (two targets of interest and one housekeeping protein) on the same blot when used with the hFAB Rhodamine Housekeeping Protein Fluorescent Primary Antibodies. The antibodies work seamlessly on nitrocellulose or low-fluorescence PVDF membranes and all other aspects of the standard western blotting workflow remain unchanged.

The antibodies are labelled with a bright fluorescent dye, resulting in short exposure times and a high signal-to-noise ratio. This property stems from the presence of multiple donor-acceptor pairs in each polymer molecule, which enable it to efficiently absorb and emit light. The product's 520 nm emission wavelength means the StarBright Blue 520 Fluorescent Secondary Antibody can pair with a StarBright Blue 700 Fluorescent Secondary Antibody or with other traditional fluorescent antibodies. It conjugates to highly cross-adsorbed IgG, which leads to low non-specific binding.

The antibodies can detect low-abundance protein targets in exposure times that are two to four times shorter than those of traditional fluorescent antibodies, according to the company.

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

Microplate reader

BMG LABTECH's CLARIOstar multimode microplate reader with Atmospheric Control Unit (ACU) offers full flexibility in cellular assays, allowing scientists to independently regulate and ramp O_2 and CO_2 concentrations from 0.1–20% over time.

Combined with BMG LABTECH's patented Linear Variable Filter (LVF) Monochromator technology, the CLARIOstar is not only said to be the most sensitive monochromator-based plate reader today, it is suitable for a wide range of applications such as long-term cell proliferation, migration and invasion studies, hypoxia and cytotoxity, pH control, viral uptake, microbial growth assays and measuring metabolic activity.

The versatility of continuously adjustable wavelengths and bandwidths means that users no longer need to choose between performance and flexibility. The modular microplate reader can feature up to six different detection modes with a dedicated full-spectrum UV/Vis spectrometer for absorbance, a high-energy laser for AlphaScreen and high sensitivity for fluorescence intensity (including FRET), fluorescence polarisation, luminescence (including BRET) and time-resolved fluorescence (including TR-FRET).

BMG LABTECH's microplate readers are said to be reliable, provide high quality data output and increase productivity. Additional value is provided by lower reagent use, unlimited software licences, and free application and technical support.

BMG LABTECH Pty Ltd
www.bmglabtech.com

Automated liquid handling system for drug discovery

The dragonfly discovery is an automated liquid handling system that has been designed specifically for assay development and high-throughput screening (HTS) — two processes that are complicated and time-consuming, but critical in the drug discovery process.

The product addresses these issues and provides a simple-to-use solution that is said to reduce assay development time while at the same time improving assay robustness in screening. It provides researchers with a platform for the easy development, validation and screening of complex assays in a robust manner.

The fully controllable liquid handling system allows users to develop assays for up to 1536-well plates and then to carry out subsequent validation and HTS. The instrument's versatility and simple yet powerful software make it suitable for hit to lead and lead optimisation, enabling users to use the platform for the entire drug discovery process.

Using up to 10 channels, the user can create complex assay formulations. Each channel is independent, but all can be operated simultaneously resulting in fast and flexible dispensing. The product uses non-contact dispensing from disposable tips, ensuring that there is no cross-contamination between wells.

Accurate dispensing of any liquid is accomplished by positive displacement pipetting, regardless of viscosity. A tight-fitting piston in a pipette barrel aspirates and dispenses the user's liquids. Careful control of parameters such as distance, rates of acceleration and deceleration of the piston ensure the exact volume of liquid is delivered every time.

AXT Pty Ltd
www.axt.com.au

RNA cells-to-CT kits

Thermo Fisher Scientific has launched its Invitrogen TaqMan and SYBR Green Fast Advanced Cells-to-CT Kits. Users will experience a fast reverse transcriptase reaction and have access to a qPCR master mix system fully optimised to improve sensitivity to detect rare transcripts. This makes it possible to perform high-throughput expression analysis directly from cultured cells without RNA purification and without risking sensitivity.

The product offer researchers fast workflows and high sensitivity and detection of abundant and rare transcripts. The kits help save time and offer a simple workflow that is suitable for a few samples, but can also be easily incorporated into automated, high-throughput applications. Researchers can focus on higher value activities, such as analysing high-throughput drug screening data or performing supplementary genome editing or silencing validation studies.

The kits employ a 5 min lysis system to quickly lyse cultured cells while simultaneously removing genomic DNA (gDNA) and preserving RNA integrity. The Cells-to-CT Stop Solution irreversibly terminates the lysis reaction, enabling users to carry the most sample into the RT and qPCR reactions to maximise the detection of RNA transcripts.

Detecting rare RNA transcripts in low-input cell samples (10–1000) is said to be higher when samples are processed with Cells-to-CT kits compared to results from the same samples using RNA purification workflows. The kits are fully optimised with updated reverse transcription (RT) reagents for cDNA synthesis and fast TaqMan or SYBR Green master mixes for real-time PCR analysis.

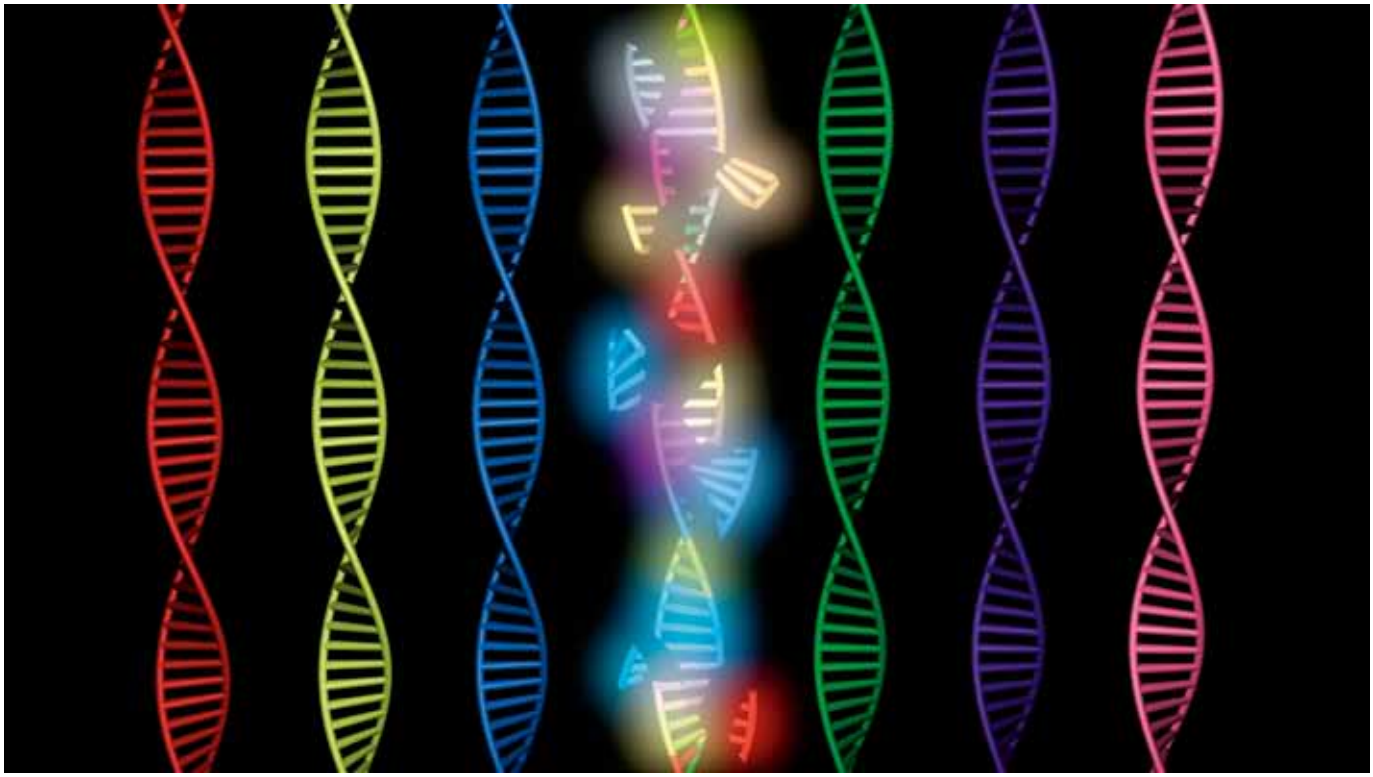
Thermo Fisher Scientific
www.thermofisher.com.au

Imaging machine for high-content screening

The Acquifer imaging machine is a fully automated microscopy system for small model organisms and cell-based screening applications. It is an easy-to-use, high-speed screening platform that is especially suitable for time-lapse recording and focused on high stability, easy maintenance, maximum experiment reproducibility and long-term data transparency. Typical applications include screening of zebrafish, drosophila, yeast, cells and 3D cell cultures.

The combination of a static microtiter plate and moving objectives provides an optimised research platform for samples in agarose, gel and water. With temperature and CO_2 control, pressure-free incubation, a linear motor and laser auto-focus, images can be acquired throughout the image acquisition process.

SciTech Pty Ltd
www.scitech.com.au



Studying mouse and human laboratory cell lines, scientists have discovered that CRISPR/Cas9 gene editing can cause greater genetic damage in cells than was previously thought.

CRISPR editing may be less precise than previously thought

The study by Allan Bradley and colleagues at the Wellcome Sanger Institute also revealed that standard tests for detecting DNA changes miss finding this genetic damage, and that caution and specific testing will be required for any potential gene therapies. The findings have been published in *Nature Biotechnology*.

CRISPR/Cas9 can alter sections of DNA in cells by cutting at specific points and introducing changes at that location. Already extensively used in scientific research, CRISPR/Cas9 has also been seen as a promising way to create potential genome editing treatments for diseases such as HIV, cancer or sickle cell disease. Such therapeutics could inactivate a disease-causing gene or correct a genetic mutation. However, any potential treatments would have to prove that they were safe.

Previous research had not shown many unforeseen mutations from CRISPR/Cas9 in the DNA at the genome editing target site. To investigate this further the researchers carried out a full systematic study in both mouse and human cells and discovered that CRISPR/Cas9 frequently caused extensive mutations, but at a greater distance from the target site.

The researchers found many of the cells had large genetic rearrangements such as DNA deletions and insertions. These could lead to important genes being switched on or off, which could have major implications for CRISPR/Cas9 use in therapies. In addition, some of these changes were too far away from the target site to be seen with standard genotyping methods.

Michael Kosicki, the first author from the Wellcome Sanger Institute, said, "My initial experiment used CRISPR/Cas9 as a tool to study gene activity; however, it became clear that something unexpected was happening. Once we realised the extent of the genetic rearrangements we studied it systematically, looking at different genes and different therapeutically relevant cell lines, and showed that the CRISPR/Cas9 effects held true."

"This is the first systematic assessment of unexpected events resulting from CRISPR/Cas9 editing in therapeutically relevant cells, and we found that changes in the DNA have been seriously underestimated before now. It is important that anyone thinking of using this technology for gene therapy proceeds with caution and looks very carefully to check for possible harmful effects," said Professor Allan Bradley, corresponding author on the study from the Wellcome Sanger Institute.

Professor Maria Jasin, an independent researcher from Memorial Slone Kettering Cancer Centre, New York, who was not involved in the study, said, "This study is the first to assess the repertoire of genomic damage arising at a CRISPR/Cas9 cleavage site. While it is not known if genomic sites in other cell lines will be affected in the same way, this study shows that further research and specific testing is needed before CRISPR/Cas9 is used clinically."

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Ultrapure water system

The arium mini essential is a compact laboratory water system for labs needing up to 10 L per day of type 1 (ultrapure) water. Rounding out the arium mini product line, the mini essential is designed to connect directly to the user's laboratory deionised or reverse osmosis water supply to produce type 1 water for use in the preparation of buffers, media and samples in both life sciences and analytical laboratories.

The arium mini essential delivers consistently high water quality for reproducible results with the option of an integrated UV lamp (185/254 nm) to reduce TOC to <5 ppb. It has an intuitive and easy-to-use colour touch-screen display with direct access to all important functions. Dispensing options, which can be used even when the user is wearing laboratory gloves, include manual, volume-controlled or of predefined volumes (Favourites function).

The compact system is space-saving; with a width of only 28 cm it will readily fit into any laboratory environment.

Sartorius Australia Pty Ltd
www.sartorius.com

Melbourne scientists reveal key

cancer-fighting gene's secret weapons

Walter and Eliza Hall Institute scientists have discovered how the key cancer-preventing gene p53 stops the development of blood cancers.

The findings revealed that a special group of genes that function within the body's normal DNA repair process were vital to the effectiveness of p53. This new information could help doctors to better identify patients with an increased risk of developing certain cancers. It could also help to develop safer, more effective treatments for patients.

Dr Ana Janic, Associate Professor Marco Herold and Professor Andreas Strasser from the Walter and Eliza Hall Institute led the study, published in *Nature Medicine*.

"In an exciting and unprecedented finding, we discovered that the DNA repair gene MLH1 and additional DNA repair genes are critical to p53's ability to prevent the development of B-cell lymphomas," said Dr Janic.

Dr Janic said revealing MLH1 as a powerful weapon for p53 in the fight against cancer could help doctors diagnose patients earlier and prescribe safer, more targeted treatments for their cancer.

"For instance, if a patient has lymphoma with a mutation that disables the DNA repair mechanism, doctors will now know to avoid certain DNA-damaging treatments, such as chemotherapy, that may only make the cancer more aggressive.

"Now that we understand the significance of MLH1 and other DNA repair factors, we can begin to find ways of identifying the vulnerabilities that their loss may impose on cancer cells with the aim of exploiting these for therapeutic benefit," Dr Janic said.

Dr Herold said the findings demonstrated the importance of conducting detailed functional analyses. "We screened more than 300 downstream targets of p53 in order to identify which genes were important to p53's tumour-suppressing function.

"It was amazing to find that the loss of the DNA repair gene MLH1 prevented p53 from functioning properly, causing the development of lymphoma. And when MLH1 was put back into the equation, tumour development was significantly stalled.

"This led us to explore other DNA repair genes and it has become clear just how important the whole DNA repair mechanism is to p53's ability to prevent cancer development," Dr Herold said.

Professor Strasser said understanding how p53 worked was a 'Holy Grail' for cancer researchers.

"Half of all cancers in the world occur as a result of p53 not functioning as it should. Researchers have long been aware of the significance of p53, but despite many studies, no-one has been able to explain how the protein is able to block cancer development until now."

"We are planning to continue our studies into the genes that are regulated by p53, digging deeper into understanding other potential processes that might impact its function," Professor Strasser said.

Dr Janic said the next steps were to see if the DNA repair process had the same cancer-blocking impact on cancers other than lymphoma, such as pancreatic and colon cancers.

"p53 is mutated in close to 70% of colon and pancreatic cancers, so this discovery could have a significant impact on understanding these diseases. We are therefore keen to test whether genes involved in the DNA repair process might also play a role in helping p53 prevent the development of these cancers," she said.

This work was supported by the Australian National Health and Medical Research Council, Cancer Council Victoria, Cure Cancer Australia, Australian Phenomics Network, Cancer Australia, the Leukemia & Lymphoma Society of America, Marie Curie Actions and Beatriu de Pinos, and the Lady Tata Memorial Trust.

Allergen detection tools for lupin

The seeds from some types of lupin can be used in foods such as seeded bread, and lupin flour is used in other foods such as pastries. Lupin usage in Australia has been increasing due to its high protein and fibre content.

In the last few years, lupin ingestion has been recognised as a cause of allergic reactions in some individuals. Since May 2018 in Australia, lupin must be declared on the labels of any food that contains it.

Foods that do not contain lupin can still be at risk of contamination, and appropriate allergen management programs can help prevent this. Part of the management program may include testing for the presence of lupin in ingredients, in finished products and even on food contact surfaces.

Two kits from Romer are now available. AgraQuant Lupin is available for the detection and quantification of lupin, with results available in just 60 min. AgraStrip Lupin is also available for the detection of lupin, with results available in under 15 min.

Romer AgraQuant and AgraStrip kits are available from AMSL Scientific.

Australasian Medical & Scientific Ltd
www.amsl.com.au

Nitrogen generator

The latest addition to Peak Scientific's Solaris range is the Solaris XE nitrogen generator.

The product can deliver up to 35 L/min at purity levels of up to 99.5%, making it a suitable gas solution for LC-MS (liquid chromatography-mass spectrometry). With variable purity in relation to outlet flow and pressure, the device is also capable of supplying compact MS instruments or multiple ELSD (evaporative light scattering detector) instruments simultaneously.

The unit has been designed to provide nitrogen to laboratories that utilise an external source of compressed air. Its compact chassis allows it to be placed on a benchtop or on a wall, making it a suitable space-saving solution for the lab.

The compact generator has no moving parts or mechanical sounds, making it a minimal-maintenance option for laboratories. It is engineered, assembled and performance tested at the company's ISO 9001 accredited manufacturing centre in the UK and backed with Peak's global on-site technical support.

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EXAIR Sanitary Flange Line Vac air-operated conveyors can be used to convey materials through systems which require frequent or mandatory cleaning. The ISO 2852 compatible sanitary flanges limit areas where bacteria can grow and help prevent contamination.

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The conveyors eject a small amount of compressed air to produce a vacuum on one end with high output flows on the other. The response is instantaneous and regulating the compressed air pressure provides infinite control of the conveying rate. Applications include material conveying, part transfer, fibre tensioning, scrap trim removal and filling operations. The products are CE compliant, meet OSHA pressure requirements and are ready to ship from stock.

Additional families are available to fit hose, tube or threaded pipe. Smaller and larger sizes are available for NPT threads, hoses and pipes. Several other materials are available including aluminium, type 303 and type 316 stainless steel. Heavy-duty versions are available in hardened alloy for abrasion resistance and maximum conveying power.

Compressed Air Australia Pty Ltd
www.caasafety.com.au

Reduce the need for time-consuming and expensive analysis using Multi-Angle Dynamic Light Scattering (MADLS)

Achieve higher resolution particle size and concentration analysis.

When producing particles of a known size, the amount of uniformity of the sample in terms of size and shape is essential to ensure consistency in biological experiments. In nanoparticle-based drug delivery studies for example, size and shape are important parameters that control the kinetics of internalisation, biodistribution, and cargo loading efficiency. While Transmission Electron Microscopy (TEM) is commonly used to characterise samples for QC, the technique can be time consuming, expensive and require an experienced user for the analysis. Multi-Angle Dynamic Light Scattering (MADLS) is a new technology from Malvern Panalytical that can reduce the amount of TEM analysis required and together with Adaptive Correlation can convey new insights into key sample properties including aggregate formation.

Why use light scattering?

Dynamic light scattering (DLS) is a non-invasive, well-established technique used to characterise molecules and particles typically in the submicron region, and with the latest technology lower than 1nm. The frequency and intensity of the scattered light can be measured to determine the size and charge of materials. This information is commonly used to shorten development time for, and improve the stability of, colloidal (including protein) and emulsion formulations, and to assess the levels of aggregation in a system.

The enduring appeal of the Malvern Zetasizer series

For over two decades, the Zetasizer range has been the de facto standard for performing DLS measurements on a wide range of particles and materials. Zetasizer systems are used across many industry sectors worldwide, delivering value in the control and optimisation of processes, and the improvement of product quality, stability and performance. They are central in academic settings, indispensable in a wealth of application spaces and referenced in tens of thousands of peer-reviewed publications.

The Zetasizer offers an easy-to use, highly flexible sizing method which is rapid, accurate and repeatable. It requires only small volumes of sample for analysis, and is non-destructive. Patented Non-Invasive Back-Scatter (NIBS) technology combines back-scatter detection with variable measurement positioning to significantly increase the range of sample concentration and size that can be measured, compared to conventional DLS.

Pushing the limits of DLS with the new Malvern Zetasizer Pro and Ultra

Built on the market-leading Zetasizer Nano range, the new Zetasizer Pro and Ultra systems from Malvern Panalytical are the latest iteration of the Zetasizer series. Several unique and powerful capabilities have been integrated in the new Zetasizer range, including:

Adaptive Correlation to characterise aggregated material

By using statistical analysis and optimised data collection, Adaptive Correlation helps to improve the repeatability of DLS particle size measurements and the ability to measure primary particle sizes separately to rare amounts of aggregated material. These improvements mean that faster, higher precision measurements may be achieved with less need for filtering of samples and dispersants.

Multi-Angle Dynamic Light Scattering (MADLS®) for size and concentration analysis

A key differentiator of the Zetasizer Ultra is its patented MADLS technology, which automates multiple-angle size measurements, providing higher resolution and more complete particle size distributions. MADLS also enables calibration-free particle concentration analysis, resolving the individual concentrations of different size populations. The new disposable capillary sizing cell provides non-destructive, low volume (3µL) analysis, extending the upper range to 10µm and delivering high-quality data while reducing cost.

Deep learning for simple method design and reliable, high quality data

The Zetasizer Pro and Ultra systems are controlled by groundbreaking ZS Xplorer software, introducing new sample-centric workflows, which make method design and data analysis more straightforward for both new and experienced users. This intelligent network provides feedback on results and offers clear advice on how data may be improved if required.

If you would like further information or a free demonstration using the New Zetasizer Ultra, please contact us.

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Walkaway automation for Karl Fischer titration

Automating volumetric titration in a whole series of samples can be a challenge. First there is the risk of ambient moisture compromising sample integrity, and there is also the necessity to start the titration in due time for each sample. Both challenges required the attention and constant presence of the lab technician during the analysis.

With the OMNIS Sample Robot, users can analyse water content in up to 50 samples completely unattended. The robot features Dis-Cover, a technology that covers the sample vials automatically with an air- and dustproof lid — protecting them from ambient moisture even for extended time periods. Users thus benefit from reproducible results.

The OMNIS Karl Fischer system no longer requires the presence of the user during the analysis, as the solvent addition and titration is started automatically by the system. Users may therefore dedicate their time to other tasks in the laboratory while their samples are analysed for water content completely unattended.

Metrohm Australia Pty Ltd
metrohm.com.au

Multiplex biomarker detection system

Quanterix has expanded its single molecule array (Simoa) technology platform portfolio to include the SR-X benchtop instrument. The product uses single molecule measurements to assess previously undetectable proteins and can reduce sample volume requirements when compared to alternative approaches, according to the company — all in a benchtop format that can be easily integrated with existing automation platforms.

In addition to a small instrument footprint, the unit has been optimised for increased multiplexing capabilities, making it an easy-to-use option for high-sensitivity biomarker analysis of either proteins or nucleic acids. It is capable of measuring nucleic acids with ultrasensitivity, without utilising polymerase chain reaction (PCR).

The SR-X is part of a complete solution including a menu of more than 70 ultrasensitive protein detection assays, as well as a series of multiplex assays for critical biomarkers, including the first six-plex Simoa assay for quantitative measurement of elusive inflammatory biomarkers in the blood. Simoa technology also enables measurement of ultrasensitive nucleic acid levels, including miRNA, without utilising PCR methodologies.

Simoa's multiplexing capabilities and digital sensitivity provide the ability to measure economically circulating clinically relevant concentrations of immunological mediators, exosomes and miRNA in a single benchtop instrument. Research has shown that the platform has the potential to detect biomarkers in the subclinical state, which is valuable in the monitoring of neurodegeneration in diseases like Alzheimer's and multiple sclerosis.

GeneWorks
www.geneworks.com.au

ATEX certified portable oxygen analysers

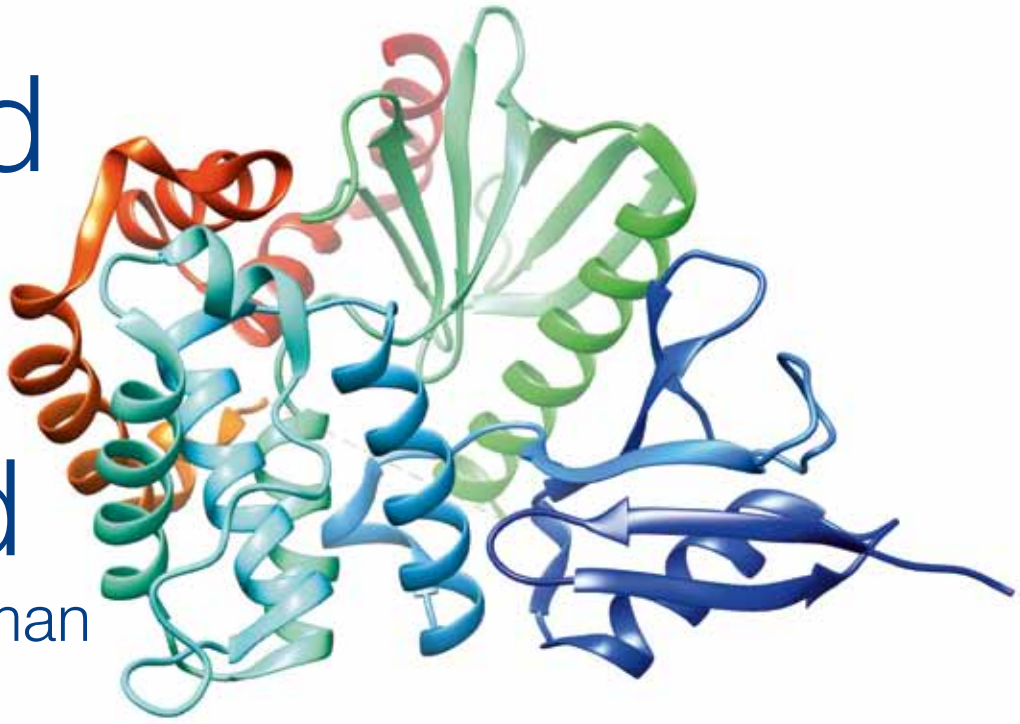
The portable galvanic electrochemical oxygen analyser range from Advanced Instruments Inc (AII) now has ATEX approval for use in atmospheres containing acetylene and/or hydrogen. The certified instruments include the GPR-1000, GPR-1100 and GPR-2000 portable range and the GPR-1200 premium portable analyser, which are used to measure oxygen to ensure product quality or avoid potentially explosive atmospheres by detecting leaks.

Using AII's galvanic oxygen sensors, the portable analysers are simple to use with low maintenance. The sensors have a life between 24 and 32 months, and replacing them is quick and easy to do.

The portables have an innovative design which is said to eliminate the waiting time between measurements, providing an instant purge and a fast response to changes in oxygen levels. The instruments also feature a sample bypass system that isolates the sensors from high concentrations of air and allows a quick recovery from an upset. They are convenient to use in the field, with a long battery life of up to 30 days on a single charge.

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

Detailed protein data isolated from single human cells



US researchers have obtained a slew of key information about proteins from single human cells for the first time — the most protein data ever collected from a single mammalian cell, in fact — giving scientists one of their clearest looks yet at the molecular happenings inside a human cell.

Until now, detailed information on proteins inside single cells was hard to come by. The raw 'data' — the amount of each protein — in a cell is extraordinarily scant and hard to measure. That's largely because scientists can't amplify proteins the way they can genes or other molecular messengers.

That has all changed thanks to the work of scientists at the US Department of Energy's (DOE) Pacific Northwest National Laboratory (PNNL), who analysed single cells — first from cultured cells and then from the lungs of a human donor — and detected on average more than 650 proteins in each cell — many times more than conventional techniques capture from single cells. Their study has been published in the journal *Angewandte Chemie*.

Top image: The structure of the protein ezrin, which the PNNL team found to be highly abundant in lung epithelial cells compared to mesenchymal cells. The protein plays an important role in how the lung epithelium forms. Image credit: RCSB PDB.

The team made the findings thanks to a technology created at the Environmental Molecular Sciences Laboratory (EMSL), a DOE Office of Science user facility located at PNNL. The technology, called nanoPOTS, was developed to measure proteins in a tiny, almost unimaginable amount of material.

"nanoPOTS is like a molecular microscope that allows us to analyse samples that are 500 times smaller than we could see before," said analytical chemist Ryan Kelly, corresponding author of the paper. "We can identify more proteins in one cell than could previously be identified from a group of hundreds of cells."

That's important for a couple of reasons. Some proteins exert immense influence within a cell, perhaps determining whether the cell will live, die, mutate or travel to another part of the body, even when they are at very low levels that are undetectable using today's methods.

In addition, conventional technologies typically analyse hundreds or thousands of cells, pooling them into one batch for analysis. Those findings represent an average view of what's happening in that tissue; there is little insight to what's actually happening in a specific cell. That's a problem if there's variability from cell to cell — if some cells are behaving normally while other cells are cancerous, for instance.

In the current study, the team analysed the proteins in a sample of fluid that is less than one-ten-thousandth of a teaspoon. Within that sample, the proteins amounted to just 0.15 ng — more than 10 million times smaller than the weight of a typical mosquito.

Ying Zhu, a developer of the nanoPOTS technology, places a chip containing samples for analysis into the automated system. Image credit: Andrea Starr/PNNL.

But working with such a tiny sample poses significant roadblocks to single-cell analysis. As the material is transferred from one test tube to another, from machine to machine, some of the sample is lost at every stage. And when the original sample amounts to no more than a microscopic droplet, losing even a tiny bit of the sample is catastrophic.

Kelly and his colleague Ying Zhu developed nanoPOTS, which stands for nanodroplet Processing in One pot for Trace Samples, to address this problem of sample loss. The technology is an automated platform for capturing, shunting, testing and measuring tiny amounts of fluid. Keys to the technology include a robot that dispenses the fluid to a location with an accuracy of one millionth of a metre, moving between tiny wells that minimise the amount of surface area onto which proteins might glom.

A scientist places a chip into the nanoPOTS system. Once the chip is in place, a robot dispenses fluid into the wells with an accuracy of one-millionth of a metre — a precision necessary when the total fluid sample is no more than one-ten-thousandth of a teaspoon. Image credit: Andrea Starr/PNNL.

Within those tiny wells, the scientists ran several steps to isolate the proteins from the rest of the sample. Then, the material was fed into a mass spectrometer that separates out and measures each of hundreds of proteins.

The technology was found to reduce sample losses by more than 99% compared to other technologies, giving scientists enough of the scant material to make meaningful measurements — to tell which proteins are at high levels and which are at low levels. That's vital information when comparing, for example, brain cells from a person with Alzheimer's disease to those from a person not affected, or looking at cells that are cancerous compared to nearby cells that are healthy.

The PNNL group is currently developing a protein map of cancerous tumours, with funding from the National Cancer Institute under the Beau Biden Cancer Moonshot Initiative. They have also used nanoPOTS to get a closer look at the proteins involved in the development of type 1 diabetes in the pancreas.

Multiphoton detection unit

Scientifica's multiphoton detection unit, the MDU XL, is optimised for multiphoton imaging in deep, scattering tissue. It has been optimised to deliver crisp and deep images.

The MDU XL has been found to enable up to 35% more efficient light collection than the standard MDU, in multiphoton imaging experiments involving up to two colours. It is also said to exhibit a superior signal-to-noise ratio as a means of acquiring a higher calibre of data.

The product can be fitted with two photomultiplier tubes (PMTs) in order to facilitate the collection of photons from two simultaneous channels and is compatible with a number of large back aperture objectives. It can be fitted with up to two gated or protected GaAsP PMTs to maximise sensitivity.

The detection unit incorporates compatibility with M32, M27, M25 and RMS threaded objectives. Its primary detection dichroic has dimensions of 60 x 40 x 1 mm and its collection lens has a diameter of 45 mm.

SciTech Pty Ltd
www.scitech.com.au

GCxGC time-of-flight mass spectrometer

The Pegasus BT 4D offers enhanced sensitivity by coupling LECO's benchtop Pegasus BT time-of-flight mass spectrometer with its high-performance GCxGC thermal modulation system. This combination gives the product the ability to interrogate challenging samples where high sensitivity is needed. The StayClean ion source eliminates the need for source cleaning, while a convenient benchtop package saves space in the laboratory.

The enhancement of S/N with the GCxGC modulation process makes what was once unobserved a clearly identifiable analyte. LECO's ChromaTOF brand software works seamlessly with the spectrometer to automatically process user data and remove the guesswork involved with analyte identification and quantification. Features such as NonTarget Deconvolution, Target Analyte Find, library searches and an easy-to-configure interface all come together to give users a good GCxGC experience.

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Scientists successfully sequence the koala genome

A team of Australian and international scientists have sequenced the full koala genome — a breakthrough which may aid in the treatment of disease and help inform conservation efforts.

The Koala Genome Consortium comprised 54 scientists from 29 different institutions across seven countries, led by Professor Rebecca Johnson, Director of the Australian Museum Research Institute, and Professor Katherine Belov from the University of Sydney. Using long-read sequencing technology and optical mapping, the team sequenced over 3.4 billion base pairs and more than 26,000 genes in the koala genome — which makes it slightly larger than the human genome.

"We sequenced and then assembled the genome with supercomputers, allowing the consortium to study the >20,000 genes of this unique species," said Professor Marc Wilkins, Director of the Ramaciotti Centre for Genomics at UNSW, where the base pairs were sequenced and assembled.

"We did so using new technology which can sequence very long pieces of DNA. This allowed us to do a very high-quality genome assembly — meaning that the result is the best marsupial genome to date, and one that's on par with the human genome in terms of its quality, which is incredibly exciting."

Unlocking the genomic sequence gave the scientists unprecedented insights into the unique biology of the koala, now shared in the journal *Nature Genetics*. For example, the authors found an expansion of the gene families relating to detoxifying enzymes, which enable koalas to live off of phenolic-rich eucalyptus leaves. They then catalogued smell and taste receptor genes that help koalas select the most nutritious and moisture-rich leaves.

Another important discovery was the characterisation of the composition of koala milk. Like all marsupials, koalas do most of their development in the pouch. They are born without an immune system after 34–36 days' gestation and spend approximately six months developing in the pouch.

"We characterised the main components of the mother's milk, which is crucial for koala joeys," Professor Belov said. "We identified genes that allow the koala to fine-tune milk protein composition across the stages of lactation, to meet the changing needs of their young.

"The team was able to analyse and discover koala-specific milk proteins that are critical for various stages of development. It also appears these proteins may have an antimicrobial role, showing activity against a range of bacterial and fungal species, including *Chlamydia pecorum*, the strain known to cause ocular and reproductive disease in koalas."

Chlamydia has severely impacted koala populations in NSW and Queensland, so scientists hope to use information gained from the koala genome in order to fight it. Other threats to koala survival include loss of habitat through land clearing and urbanisation, which results in a reduction of habitat connectivity and reduced genetic diversity, and puts koalas at high risk of inbreeding, which leads to reduced genetic diversity.

"For the first time, using over 1000 genome linked markers, we are able to show that NSW and Queensland populations show significant levels of genetic diversity and long-term connectivity across regions," Professor Johnson said.

"Ensuring this genetic diversity is conserved in concert with other conservation measures to protect habitat, reduce vehicle strikes, dog attacks and disease is the keys to the long-term survival of the koala."

All of the sequence data generated by the consortium has been deposited into public databases and made freely available to scientists around the world, maximising the benefits that koala populations will potentially receive from such research. Professor Johnson said the team's next efforts "must be in the application of these findings to genetically manage koala populations and advance the treatment of the diseases affecting koalas, with the goal of conserving this very important species".

But koalas won't be the only ones to benefit from the research, with Professor Wilkins noting that the genome's high quality makes it "a fundamental resource for all the other marsupial genomes which have yet to be generated and studied".

"We will be able to use this as a reference for the entire marsupial community," he said.

Cryogenic grinding mill

The 6775 Freezer/Mill is SPEX's small cryogenic grinding mill that accommodates sample sizes ranging from 0.1–5 g. It is specifically designed for grinding and pulverising tough and/or temperature-sensitive samples immersed in liquid nitrogen.

The product is capable of grinding almost anything, according to the company. Typical samples that can be processed in the grinding mill include plant and animal tissues, seeds, plastic and polymers, pharmaceuticals, food products, electronic components, textiles and fibres, hair, teeth and bones.

The unit features a small cryogenic impact grinder with a self-contained liquid nitrogen tub and insulated case. Grinding vial sets are offered in a variety of materials, including polycarbonate, stainless steel and Cr-free steel. A pre-cooling chamber holds up to three additional grinding vials for high-throughput sample processing.

The device is equipped with a liquid nitrogen level sensor and lid safety interlock for operator protection. Closed grinding vials eliminate sample cross-contamination. A magnetically driven impactor is the only moving part, so there are no mechanical linkages or bearings to fail.

The product stores up to 20 user-defined grinding programs for quick and easy recall. Programmable parameters include grinding time, impactor rate, and pre-cooling and cooling times.

A touch-screen control panel is detachable and can be used for remote operation. Run history can be uploaded onto a USB memory stick and training videos can be viewed on-screen.

AXT Pty Ltd
www.axt.com.au

AGTA 2018

The Australasian Genomic Technologies Association (AGTA) conference, Australia's foremost genomic technology conference, is an essential event for researchers and industry representatives who work with genomic technologies in a variety of contexts including platform development, medical genomics, functional genomics, non-model systems, epigenomics and plant genomics.

What:
The 18th annual AGTA conference

Where:
Stamford Grand Hotel in Glenelg, Adelaide

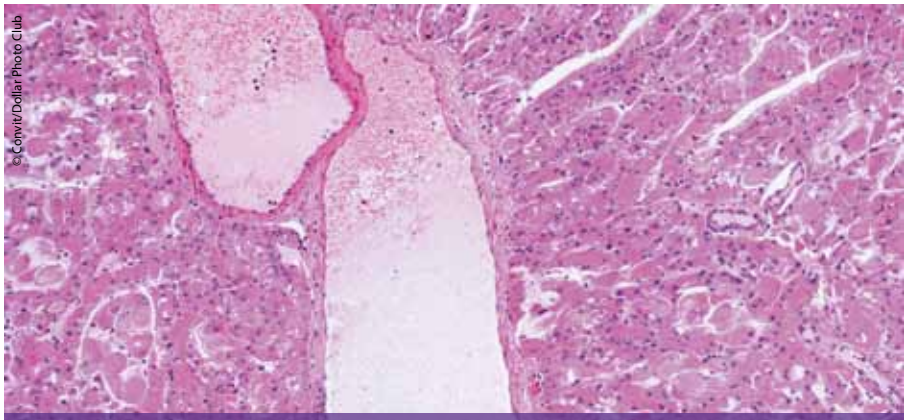
When:
4–7 November 2018

Web:
www.agtaconference.org

The AGTA conference covers all aspects of genomic science, technologies and their applications. This year's event will cover a range of topics including cancer genomics, neurogenetics, bioinformatics, computational biology, plant and animal genomics, microbial and meta genomics, ancient DNA as well as highlights of emerging genomic technologies. The AGTA meeting attracts a diverse range of participants including researchers, service providers, industry representatives and students. The conference offers an important opportunity for computational biologists, bioinformaticians and data visualisation specialists to interact with technologists and biologists. This unique mix is one of the reasons that the Australian genomics community has a dynamic cross-disciplinary and innovative approach to genomic analysis, and is at the forefront of analysis tools for new types of 'omics' data.

Confirmed keynote speakers include:

- Elizabeth Dinsdale, San Diego State University
- Daniel Geschwind, University of California, Los Angeles
- Jim Haseloff, University of Cambridge
- Ludovic Orlando, University of Copenhagen
- Taru Tukiainen, University of Helsinki
- Kevin White, The University of Chicago
- Marlon Stoeckius, New York Genome Center
- Jacqueline Batley, The University of Western Australia
- Nicole Cloonan, University of Auckland
- Michael McDonald, Monash University
- Gene Tyson, The University of Queensland
- Nic Waddell, QIMR Berghofer
- Sally Ann Harbison, ESR
- Ryan Lister, The University of Western Australia
- Naomi Wray, The University of Queensland



ComBio2018
September 23–26, Sydney
ComBio is the major ASBMB conference held each year, in association with Australian Society of Plant Scientists, Australia and New Zealand Society for Cell and Developmental Biology, International Society of Differentiation, New Zealand Society of Plant Biologists and New Zealand Society for Biochemistry and Molecular Biology. Themes include Plant Biology; Developmental, Stem Cell and Regenerative Biology; Immunology, Infection, Host; Proteins and Structural Biology; Omics, Epigenetics and Bioinformatics; Cell Biology and Signalling; Biochemistry and Metabolism; Emerging Technologies; and Education.
http://www.combio.org.au/combio2018/

International Society for Clinical Biostatistics and Australian Statistical Conference 2018
August 26–30, Melbourne
http://iscbasc2018.com/

SAFETYconnect 2018
August 29–30, Brisbane
www.safety-connect.com.au/

GeneMappers2018
August 29–31, Brisbane
http://www.qimrberghofer.edu.au/genemappers18/

AusAg & Foodtech Summit 2018
September 3–4, Melbourne
http://agfoodtech.com.au/

ASCIA 2018 conference
September 4–8, Canberra
http://www.ascia2018.com/

16th International Congress of Therapeutic Drug Monitoring & Clinical Toxicology 2018
September 16–19, Brisbane
https://iatdmct2018.org/

ComBio2018
September 23–26, Sydney
http://www.combio.org.au/combio2018/

3rd Joint conference of the Asia-Pacific EPR/ESR Society and the International EPR (ESR) Society (IES) Symposium
September 24–28, Brisbane
http://www.apes-ies2018.org/

Australian Society for Fish Biology Conference 2018
October 7–11, Sydney
http://asfb2018.org.au/

Melbourne International Joint Breast Congress (MIBC)
October 11–13, Melbourne
http://melbournebreast2018.org/

Neutrons and Food 5
October 16–19, Sydney
http://www.ansto.gov.au/Events/Neutronsandfoodconference2018/index.htm

2018 Cutaneous Biology Meeting
October 29–November 1, North Stradbroke Island
http://cutaneousbiology2018.org/

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

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

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