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HIV ELIMINATED
FROM MOUSE GENOMES

DNA MICROSCOPY
A NEW WAY TO IMAGE CELLS

BIOLOGICS INNOVATION
FACILITY OPENS

AUG/SEP 2019
VOL.30 NO.3
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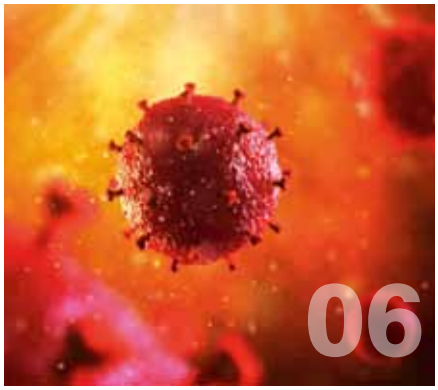

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One small step

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As I write this editorial, the world's media is still abuzz following the 50th anniversary of *Apollo 11*'s journey to the Moon, finally touching down on 20 July 1969. For a (relatively) young person like myself, who wasn't born for a couple of decades after the fact, it can be easy to take this feat for granted — for me, the capability to travel to the Moon has always been there, so it doesn't seem that impressive. For those who were alive at the time, however, it will be remembered as a moment that changed the world — and though humanity has arguably been a bit slow at the whole space exploration thing, compared to the science-fiction programs of the 20th century, it certainly seems like there has been a renewed interest in the idea lately.

Speaking of which, the Australian Space Agency has been in the news once again, with the Australian Government recently signing an MoU to provide a $6 million investment in Western Australia's space capabilities — a deal aimed at encouraging partnerships and engagement with the global space ecosystem in order to drive economic growth. The investment comes in two parts, both to be delivered in collaboration with the WA Government:

$4.5 million towards a robotics and artificial intelligence mission control facility, which will advance the remote operation of autonomous and robotic systems in space.

$1.5 million to support space data analysis facilities, which will support analysis of satellite data for areas such as mining, agriculture, emergency services and maritime surveillance, and will build capability in data analysis for space missions.

WA Science Minister Dave Kelly claims the signing of the MoU will unlock national and international opportunities for WA businesses and academia to grow the state's space industry. Federal Science Minister Karen Andrews, meanwhile, believes WA is making a useful contribution — as other states should — towards the federal government's ambitious aim to triple the size of the Australian space sector to $12 billion and create another 20,000 jobs by 2030.

So if I wasn't alive to witness the Moon landing, what significant moments from science can I remember? One that stands out is last year's shocking case of Dr He Jiankui, the Chinese scientist responsible for the birth of two gene-edited babies. And while there were a host of ethical issues surrounding that particular story, I do find it quite extraordinary that the practice of altering living creatures at the genetic level is becoming more and more plausible. This issue we have a couple of stories on that very topic — most significantly our lead, which saw US scientists combine long-acting drug treatment and CRISPR-Cas9 technology to eliminate HIV from mice. And that's on top of all the breakthroughs that are being made every day to treat a whole host of conditions — just some of which are covered in this issue — with no genetic modification necessary.

Will the next giant leap for mankind be found within these pages? I don't know at this stage, but it should be fun finding out.

Regards,
Lauren Davis
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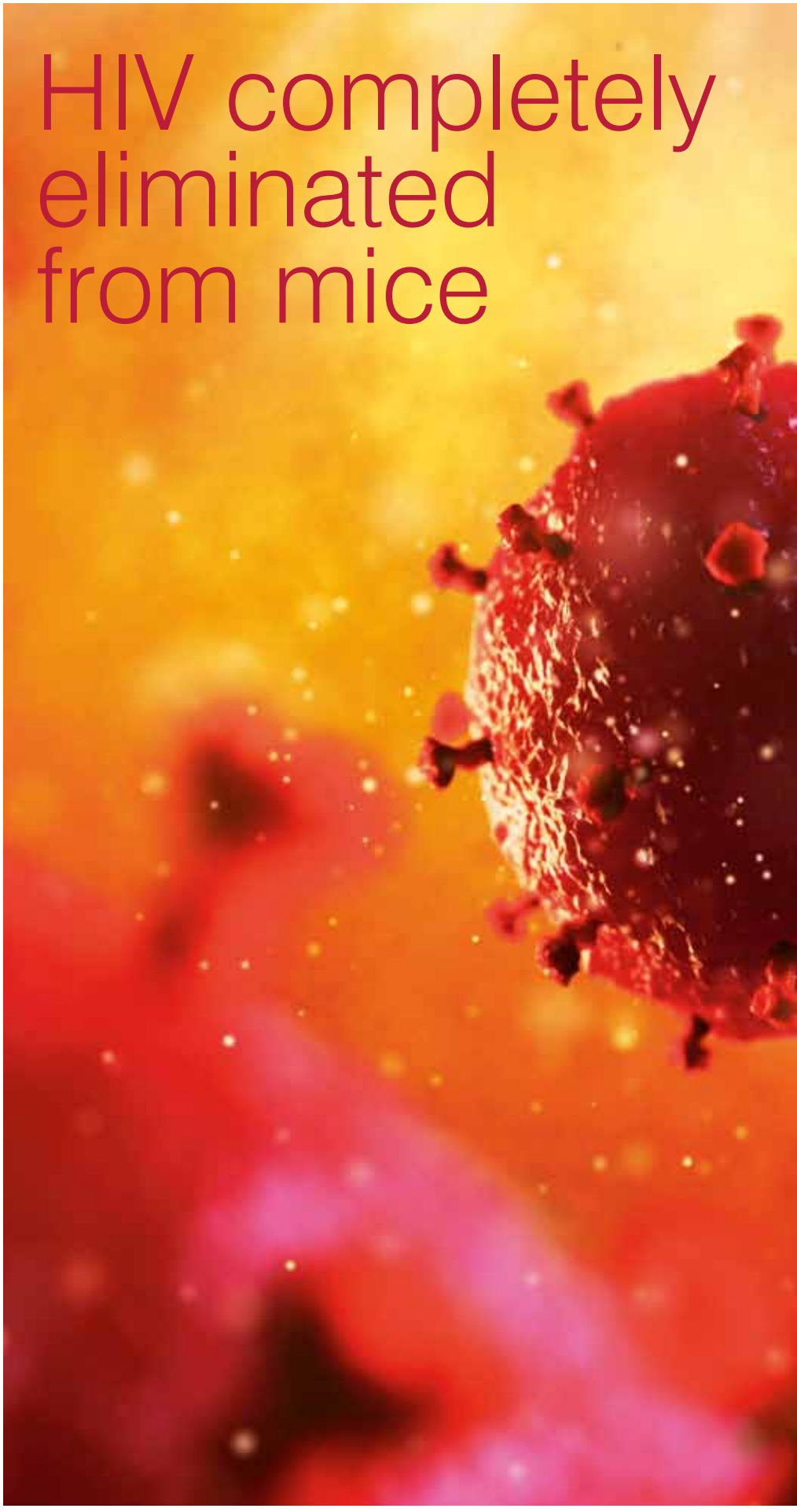
Lauren Davis

HIV completely eliminated from mice

Using a combination of long-acting drug treatment and gene editing, US researchers claim to have eliminated replication-competent HIV-1 DNA — the virus responsible for AIDS — from the genomes of living animals, marking a critical step towards the development of a possible cure for human HIV infection.



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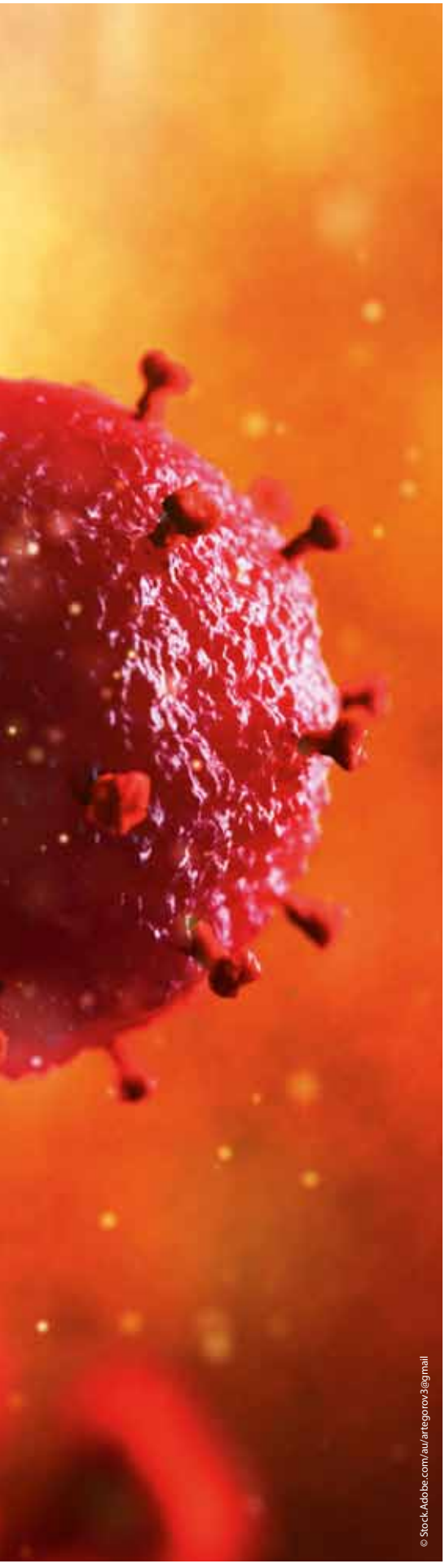
According to UNAIDS, it is estimated that more than 36.7 million people worldwide are infected with the human immunodeficiency virus type one (HIV-1), with more than 5000 individuals newly infected each day. Australia stands out as something of a world leader in HIV prevention, last year recording only 835 HIV diagnoses across the country — a decline of 23% over five years and its lowest number since 2001 — but this is largely due to reductions in the number of HIV diagnoses that are attributable to sex between men, with no declines among heterosexual, Aboriginal or Torres Strait Islander populations. Further work on both prevention and treatment is therefore required.

Current HIV treatment centres on the use of antiretroviral therapy (ART), which restricts viral infection by stalling various steps of the viral life cycle. By suppressing HIV replication down to undetectable levels, the virus becomes untransmissable in the affected person — however, ART fails to eliminate integrated copies of HIV-1 proviral DNA from the host genome, with the virus persisting in tissues including the gut, lymph nodes, brain and spleen, amongst other sites.

Furthermore, the therapy requires lifelong use in order to remain effective; indeed, if ART is stopped, HIV rebounds, renewing replication and fuelling the development of acquired immunodeficiency syndrome (AIDS) — a result of HIV's ability to integrate its DNA sequence



into the genomes of cells in the immune system, where it lies dormant and beyond the reach of antiretroviral drugs. Thus, a major issue for any HIV-1 curative strategy is the means to eliminate either integrated proviral DNA or the cells that harbour the virus without collateral cytotoxic reactions.

Now, researchers at the University of Nebraska Medical Center (UNMC) and the Lewis Katz School of Medicine (LKSOM) at Temple University — both of whom have been working on their own treatments for HIV — have pooled their resources in the hope of finally developing a cure. Senior investigators on the study were Dr Howard Gendelman from UNMC and Dr Kamel Khalili from LKSOM, and their work has been published in the journal *Nature Communications*.

In previous work, Dr Gendelman's team utilised a therapeutic strategy known as long-acting slow-effective release (LASER) ART, co-developed by UNMC Assistant Professor Benson Edagwa. LASER ART targets viral sanctuaries and maintains HIV replication at low levels for extended periods of time, reducing the frequency of ART administration.

This long-lasting medication was made possible through pharmacological changes in the chemical structure of antiretroviral drugs. The modified drug was packaged into nanocrystals, which readily distribute to tissues where HIV is likely to be lying dormant. From there, the nanocrystals, stored within cells for weeks, slowly release the drug and stop its ongoing replication.

"What's different about LASER ART is it doesn't have to be administered once a day," Dr Gendelman said. "It can be administered once every other month, once every six months and inevitably, once every year. So the problems that many patients have of being forgetful to take their medicines will vanish."

Dr Khalili's team, meanwhile, has previously used CRISPR-Cas9 technology to develop a novel gene editing and gene therapy delivery system aimed at removing HIV DNA from genomes harbouring the virus. In rats and mice, they showed that the gene editing system could effectively excise large fragments of integrated HIV-1 proviral DNA from the host genome, significantly impacting viral gene expression. Similar to ART, however, gene editing cannot completely eliminate HIV on its own — so the researchers decided to see what happened when they combined the system with LASER ART.

"We wanted to see whether LASER ART could suppress HIV replication long enough for CRISPR-Cas9 to completely rid cells of viral DNA," Dr Khalili said.

The researchers tested their idea in mice that had been engineered to produce human T cells susceptible to HIV infection, permitting long-term viral infection and ART-induced latency. Once infection was established, mice were treated with LASER ART and subsequently with CRISPR-Cas9. At the end of the treatment period, the mice were examined for viral load.

After three independent sets of studies, and several weeks following each treatment period, HIV DNA and RNA were found to be completely eliminated in about one-third of the mice, as indicated by qPCR, ddPCR and sequencing results. By contrast, HIV rebound was readily detected in 100% of mice that had received either treatment separately.

"The big message of this work is that it takes both CRISPR-Cas9 and virus suppression through a method such as LASER ART, administered together, to produce a cure for HIV infection," Drs Gendelman and Khalili said in a shared statement.

Dr Gendelman added, "This is the first time in the world that anyone, any scientist or any physician, has been able to eliminate HIV from a model system — in this case, an animal model system – of the virus."

The study has attracted the attention of scientists the world over — including Dr Robert Gallo, who co-discovered HIV as the cause of AIDS in 1984. Dr Gallo conveyed his congratulations to the researchers, saying, "In my view, this is the most interesting and important therapy-related research advance I have seen in many, many years."

With promising results in mice, the authors are now planning further studies to improve the delivery of agents to viral reservoirs and specifically eliminate latent viral infections. Ultimately, Drs Gendelman and Khalili appear optimistic about the future of the treatment, saying, "We now have a clear path to move ahead to trials in non-human primates and possibly clinical trials in human patients within the year."

Cranberries increase bacterial sensitivity to antibiotics

Cranberries are highly sought after for their tangy taste and the antioxidants they contain, but a new study from Canadian researchers provides evidence that they could also help in the fight against antibiotic resistance.

Given the popular belief that drinking cranberry juice is helpful against urinary tract infections, researchers from McGill University and Institut national de la recherche scientifique (INRS) sought to find out more about the berry's molecular properties by treating various bacteria with a cranberry extract — specifically, those responsible for urinary tract infections, pneumonia and gastroenteritis (*Proteus mirabilis*, *Pseudomonas aeruginosa* and *Escherichia coli*). The results of their study were published in the journal *Advanced Science*.

"Normally when we treat bacteria with an antibiotic in the lab, the bacteria eventually acquire resistance over time," said Professor Nathalie Tufenkji, from McGill University. "But when we simultaneously treated the bacteria with an antibiotic and the cranberry extract, no resistance developed. We were very surprised by this, and we see it as an important opportunity."

Analyses showed that the cranberry extract increases bacterial sensitivity to antibiotics by acting in two ways: it makes the bacterial cell wall more permeable to the antibiotic and it interferes with the mechanism used by the bacteria to pump out the antibiotic. Consequently, the antibiotic penetrates more easily and the bacteria have a harder time getting rid of it, so the drug is effective at lower doses.

"These are really exciting results," said study co-author Professor Éric Déziel, from INRS. "The activity is generated by molecules called proanthocyanidins. There are several different kinds of proanthocyanidins, and they may work together to deliver this outcome. We'll need to do more research to determine which ones are most active in synergy with the antibiotic."

After confirming the activity of the cranberry molecules on bacterial culture, the researchers tested to determine whether the pattern persisted in a preliminary animal model: infected insects. Since the synergistic effect of the extract and the antibiotic was also observed in the insects, further experiments will be conducted to clearly identify the active molecules.

If the results are confirmed in animals, certain classes of antibiotics subject to high levels of resistance could be made useful again by using cranberry extract to boost their potential. Prof Tufenkji said, "Our hope is to reduce the doses of antibiotics required in human and veterinary medicine as part of efforts to combat antibiotic resistance."

Heart drug could help kids with brain tumours

Scientists at the University of Nottingham have discovered that repurposing a heart drug could significantly increase the survival rate for children with ependymoma — a particularly aggressive type of brain tumour.

Published in the journal *Scientific Reports*, the findings suggest that co-treatment with a drug normally used to treat cardiac hypertrophy can overcome chemotherapy resistance and increase survival in over a third of ependymoma patients.

Ependymomas are the second most common malignant brain tumours in children. They can occur across all age groups, but the outcome for children is lower than in their adult counterpart. The poorest survival is seen in infants, with the five-year prognosis at just 42–55%.

The use of chemotherapy in children with ependymomas has had variable levels of success, leading to the frequent belief that ependymomas are chemoresistant tumours, since over half of tumours cannot be cured by chemotherapy alone. The Nottingham researchers set out to determine the nature of this chemoresistance.

The scientists showed that, in patients treated with chemotherapy alone, the presence of a chemotherapy drug-pumping protein called ABCB1 was associated with a significantly poorer outcome. Tumours that expressed ABCB1 were less likely to respond to chemotherapy and more likely to be locally invasive.

The authors then used a heart drug to inhibit ABCB1 function in cells taken from patients' tumours. The heart drug was able to stop ABCB1 pumping chemotherapy drugs out of the tumour cells, making them more sensitive to chemotherapy and less able to migrate.

With ABCB1 expressed in over one-third of patients' tumours, the hope is that all such patients could potentially benefit from repurposing the heart drug in future clinical trials. As noted by study leader Dr Beth Coyle, "We are hopeful that by combining this repurposed drug with current treatments, we can give new hope for long-term survival to patients with these devastating brain tumours."

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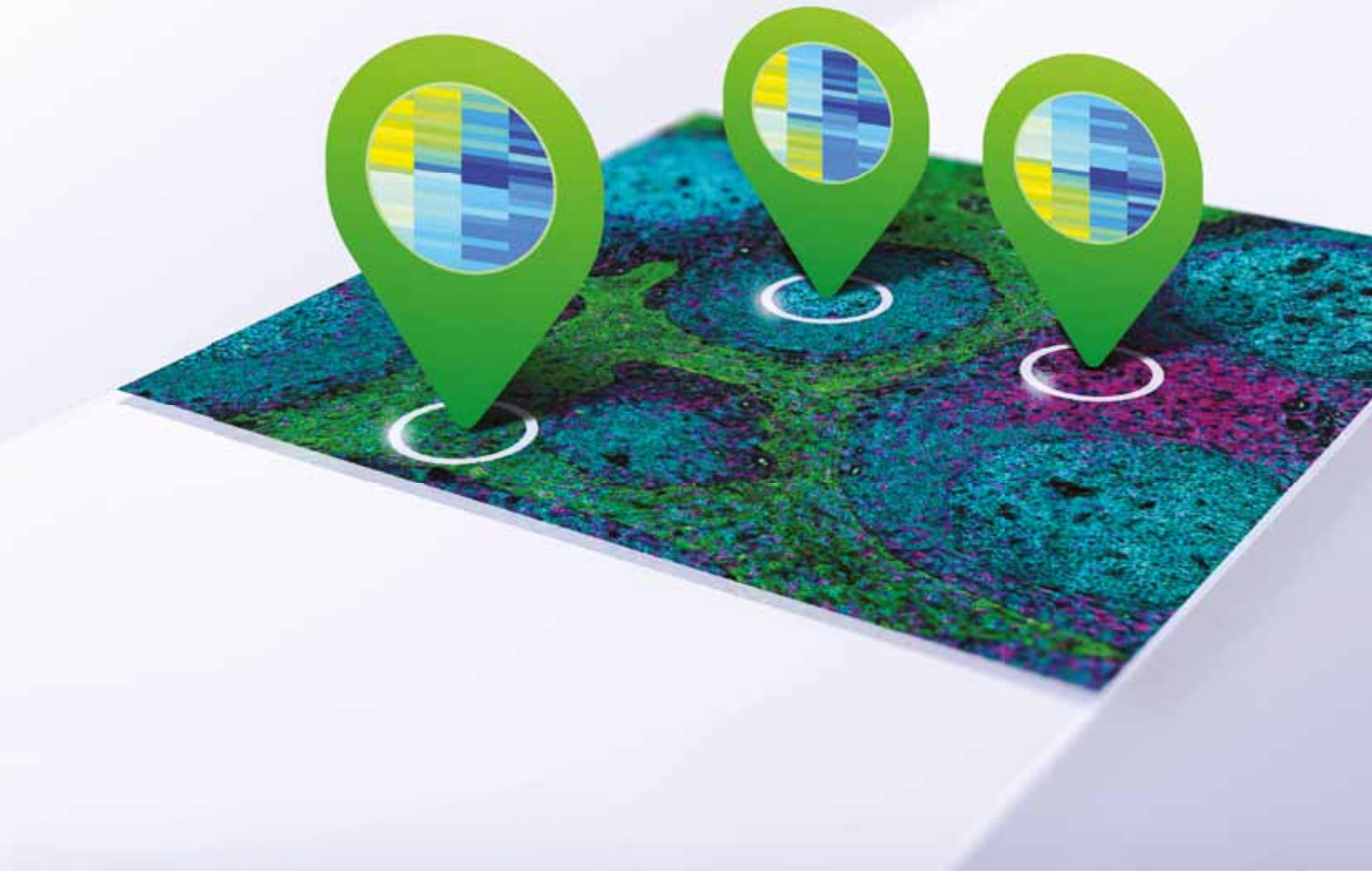

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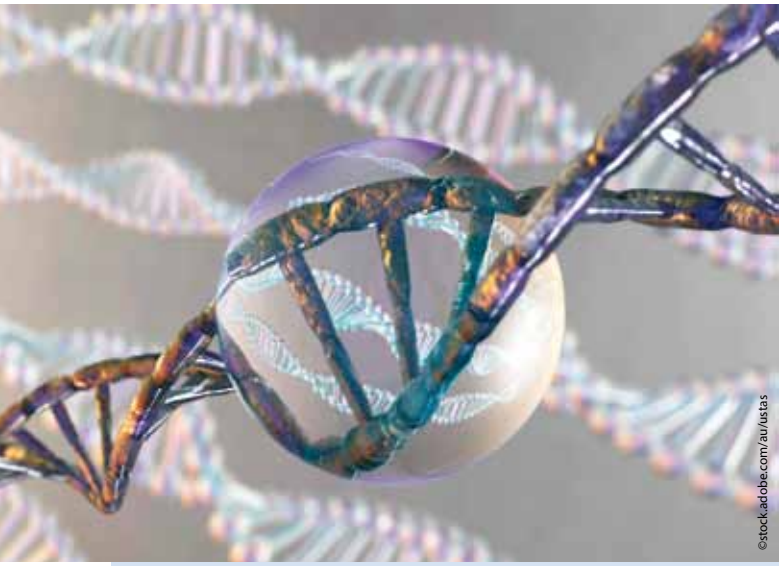

Gene for schizophrenia discovered

An 18-year schizophrenia study — made possible by the recruitment, diagnosis and DNA screening of thousands of people in India — has identified a new clue in the quest for causes of the illness and potential treatments. The research has been published in *JAMA Psychiatry*.

A collaboration between The University of Queensland (UQ) and a team of Indian researchers led by Professor Rangaswamy Thara, co-founder and director of Chennai's Schizophrenia Research Foundation (SCARF), searched the genomes of more than 3000 individuals and found those with schizophrenia were more likely to have a particular genetic variation.

As noted by Professor Bryan Mowry, from UQ's Queensland Brain Institute (QBI), such studies have predominantly been done in populations with European ancestry, with more than 100 schizophrenia-associated variants identified previously. "Looking at other populations can highlight different parts of the genome with a more robust association with the disease," Prof Mowry said.

"This study identified a gene called *NAPRT1* that encodes an enzyme involved in vitamin B3 metabolism. We were also able to find this gene in a large genomic dataset of schizophrenia patients with European ancestry.

"When we knocked out the *NAPRT1* gene in zebrafish, brain development of the fish was impaired. We are now working to understand more deeply how this gene functions in the brain."

Prof Mowry said much of the variation in schizophrenia, which occurs in about 1% of the population, is due to genetic factors. "There are now a multitude of genetic variants linked to schizophrenia, but we don't yet know what the hundreds of genes involved do," he said.

"The next phase is to study their function in normal and diseased states using computational approaches and animal models, such as the zebrafish.

"We'd like to look further into populations in India to increase our sample size to see if we can replicate this result and discover additional variants that might be involved.

"Our studies aim to shed more light on what makes people susceptible to schizophrenia and possible treatments for the future."

New drug candidate for active rheumatoid arthritis

A still-to-be-approved drug containing a selective janus kinase inhibitor has proved itself to be a new option for treating active rheumatoid arthritis (RA).

In a large-scale, international study led by renowned rheumatologist Josef Smolen, it was found that 12.5 to 20% of patients who were given the drug on a daily basis experienced so-called sustained remission — a state that is almost like being cured. The results of the study have been published in *The Lancet*.

Janus kinases (JAK) play an important role in intracellular signal transmission and are necessary to forward signals from various receptors to the cell nucleus. In rheumatism, however, they are responsible for inflammatory responses. These are curbed by JAK inhibitors.

There are currently two JAK inhibitors (tofacitinib and baricitinib) which are used for treating rheumatoid arthritis, but mostly as combination therapy with the standard therapy methotrexate. In the current study, involving more than 600 patients, the researchers were able to show that a significant improvement can be achieved with the JAK inhibitor upadacitinib as monotherapy.

"With a daily dose of 15 mg, more than one-third of patients achieved low disease activity and, at 30 mg, the proportion was nearly 50%," said Smolen, from the Medical University of Vienna. "12.5% of the group on the low dose and around 20% on the higher dose achieved so-called sustained remission; that is to say, complete disappearance of disease activity. And that was after only three months."

This treatment option is so important because RA patients are initially treated with the standard antirheumatic agent methotrexate for six months, and indeed many of them respond very well to this. However, if they do not respond and no remission or at least reduction in disease activity can be achieved, they are given a combined treatment of methotrexate and a biologic agent — frequently anti-TNF, such as adalimumab, administered by injection, which involves risk factors.

By contrast, treatment with JAK inhibitors has already been described by rheumatism experts at MedUni Vienna as being equally effective and does not involve an injection but is given in the form of a daily tablet, making it a simpler form of treatment. Speaking about upadacitinib specifically, Smolen said, "It works extremely quickly — a good response is noticeable after only two to four weeks."

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Pointing the finger at MS immune cells

Researchers have identified what they claim is the elusive 'fingerprint' of the immune cells that characterise multiple sclerosis, a chronic autoimmune disease that affects around 2.5 million people worldwide.

In multiple sclerosis (MS), dysregulated immune cells periodically infiltrate the brain of afflicted patients, causing damages to neural transmission and neuronal loss. If not properly treated, the disease leads to accumulating disabilities that greatly restrict the daily life of patients.

Researchers led by Burkhard Becher, from the Institute of Experimental Immunology of the University of Zurich, have now identified the cell population in question. The results of their work have been published in the journal *Nature Medicine*.

The researchers used high-dimensional cytometry to characterise the immune cells, which makes it possible to analyse millions of cells in hundreds of patients and determine their immune properties — in other words, their 'fingerprints'. To be able to analyse this enormous amount of data, the scientists developed an innovative machine-learning algorithm.

"Artificial intelligence and machine learning helps us to greatly reduce the data's complexity, while the interpretation of results is left to the investigators," Becher said.

Using this interdisciplinary approach the team was able to identify a population of immune cells in the peripheral blood of MS patients that differ from those in other inflammatory and non-inflammatory diseases. These dysregulated T helper cells produce a neuroinflammatory cytokine called GM-CSF and high levels of the chemokine receptor CXCR4 and the membrane protein VLA4.

"The cell population we identified therefore has two key properties that are characteristic of MS: the cytokine causes neuroinflammation, and thanks to the receptors the immune cells can get into the central nervous system," said Edoardo Galli, first author of the study.

In addition, the researchers found this characteristic signature to be highly represented in the cerebrospinal fluid and in the brain lesions of MS patients, suggesting a direct contribution to the disease. Furthermore, effective immunomodulatory therapy strongly reduces this cell population.

"Our data clearly indicate a stringent association of this signature to MS, and we believe that the identification of such an easily accessible biomarker brings important value for MS monitoring," Becher said.

The researchers noted that it is still premature to claim a disease-causing role for this population, with further studies required. However, the detailed characterisation of this population could provide important hints for new MS-specific treatments to improve the patients' care.

Drug development on a chip

Scientists of Karlsruhe Institute of Technology (KIT) have found a way to combine the separate steps required for drug development, hence facilitating and accelerating the search for promising new substances. Their work has been published in the journal *Nature Communications*.

The early phase of drug development is traditionally based on three areas of science, beginning when chemists synthesise a big library of various molecules. All compounds are produced, isolated and characterised separately; then, biologists analyse the molecule library for biological activity. Highly active compounds are returned to chemistry.

Based on this preselection, chemists synthesise further variations of these compounds. These secondary molecule libraries then contain optimised compounds. After this cycle has been repeated several times, a few promising compound candidates are tested in clinical studies.

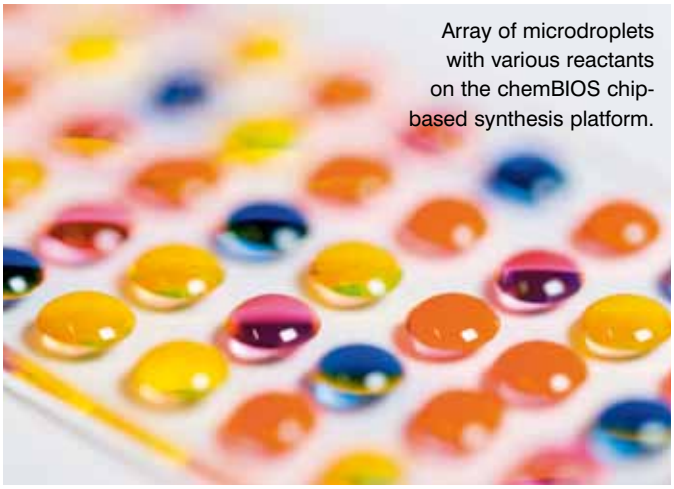
Of several thousands of compounds subjected to first screenings, only one or sometimes no compound reaches the last step of drug development: approval of the new drug. This process is time-consuming and requires a large range of materials and solvents. This makes the process expensive and inefficient — often taking more than 20 years and costing between two and four billion dollars — and limits the number of substances that can be screened.

"For this reason, we have developed a platform that combines synthesis of compound libraries with biological high-throughput screening on a single chip," said Maximilian Benz of KIT. This so-called chemBIOS platform is compatible with both organic solvents for synthesis and aqueous solutions for biological screenings.

"We use the chemBIOS platform to perform 75 parallel three-component reactions for synthesis of a library of lipids, ie, fats, followed by characterisation using mass spectroscopy, on-chip formation of lipoplexes and biological cell screening," Benz added. Lipoplexes are nucleic acid-lipid complexes that can be taken up by eukaryotic, ie, human and animal, cells.

"The entire process from library synthesis to cell screening takes only three days and about 1 mL of total solution, demonstrating the potential of the chemBIOS technology to increase efficiency and accelerate screenings and drug development," Benz said. Usually, such processes need several litres of reactants, solvents and cell suspensions.

The researchers have thus demonstrated the potential of chemBIOS technology to accelerate screenings and drug development, increasing efficiency and decreasing costs.



Array of microdroplets with various reactants on the chemBIOS chip-based synthesis platform.

Image credit: Maximilian Benz, KIT.

Collaborative robots coming to medical laboratories

Technology company ABB will introduce its collaborative robots to medical laboratories as it opens a new healthcare hub at the Texas Medical Center (TMC) innovation campus in Houston.

Set to be ABB's first dedicated healthcare research centre when it opens in October, the facility will see ABB's research team work on the TMC campus with medical staff, scientists and engineers to develop non-surgical medical robotics systems, including logistics and next-generation automated laboratory technologies. A 20-strong team from ABB Robotics will work in the 500 m^2 research facility, which includes an automation laboratory and robot training facilities as well as meeting spaces for co-developing solutions with innovation partners.

Today, a limiting factor to the number of patients who can be treated is the need for highly skilled medical experts who spend a large part of their day doing repetitive and low-value tasks, such as preparing slides and loading centrifuges. Using robots to automate these tasks will enable medical professionals to focus on more highly skilled and productive work, while ultimately helping more people to receive treatment, by speeding the testing process.

ABB has analysed a wide range of current manual medical laboratory processes and estimates that 50% more tests could be carried out every year using automation, while training robots to undertake repetitive processes will reduce the need for people to do tasks which cause repetitive strain injury (RSI). In addition to improving the quality of patient care, increasing healthcare efficiency through automation could also ease some of the societal, political and financial challenges that an ageing population will cause.

"The next-generation laboratory processes developed in Houston will speed manual medical laboratory processes, reducing and eliminating bottlenecks in laboratory work and enhancing safety and consistency," said Sami Atiya, President of ABB's Robotics and Discrete Automation business. "This is especially applicable for new high-tech treatments, such as the cancer therapies pioneered at the Texas Medical Center, which today require manual and time-consuming test processes."

ABB's collaborative robots, which already operate in food and beverage laboratories worldwide, are suited to medical facilities as they don't require safety fences to operate safely and efficiently alongside people. There, the robots will undertake a range of repetitive, delicate and time-consuming activities including dosing, mixing and pipetting tasks as well as sterile instrument kitting and centrifuge loading and unloading.

"We are proud to co-develop collaborative robotics systems for the hospital of the future with one of the world's most advanced partners and to test them in real-world laboratories to ensure they add value to healthcare professionals, driving innovation and transforming how medical laboratories operate worldwide," Atiya said. "A key element of ABB's long-term growth strategy is to continue to invest and innovate in service robotics, bringing our automation expertise to new areas such as health care and building on our automotive and electronics sectors business."

"With this exciting partnership, Texas Medical Center continues to push the boundaries of innovative collaboration with cutting-edge industry partners by establishing TMC as the epicentre for ABB Robotics' entry into the healthcare space," said TMC President and CEO Bill McKeon. "Operating a city within a city that sees 10 million patients on an annual basis, it is essential to prioritise efficiency and precision, and to develop processes that are easily repeatable in nature. By bringing ABB into the fold at TMC Innovation with this first-of-its-kind R&D facility for creating robotics solutions in health care, TMC is emphasising its commitment to doing just that."

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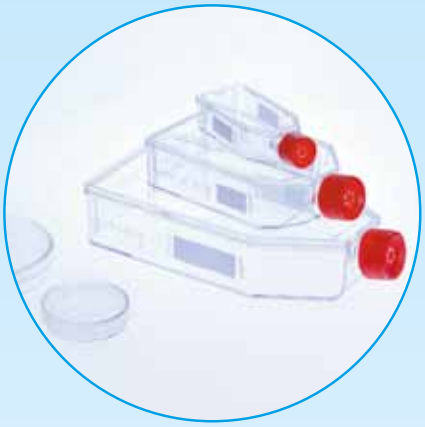

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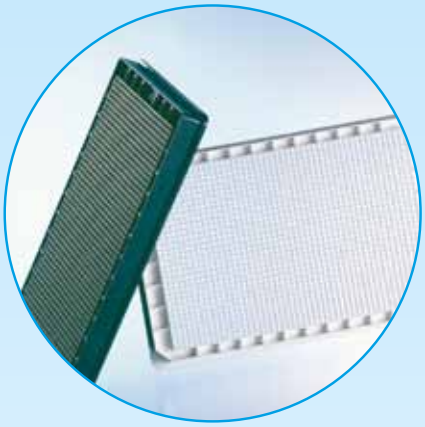
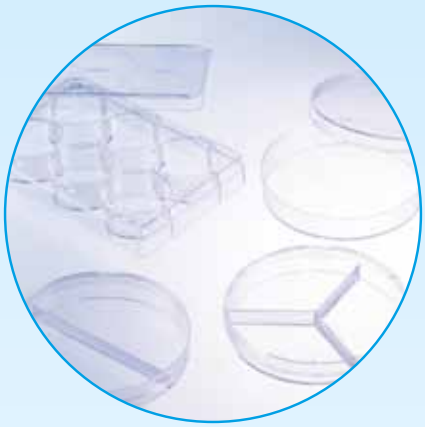


Microbiology



Centrifugation

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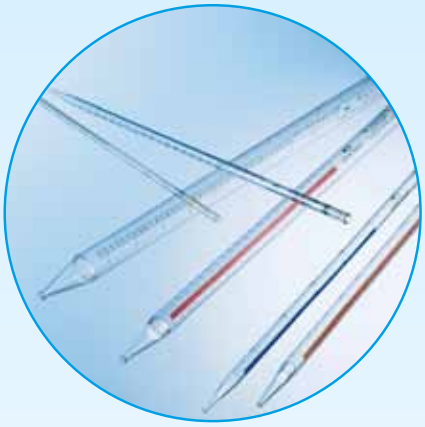
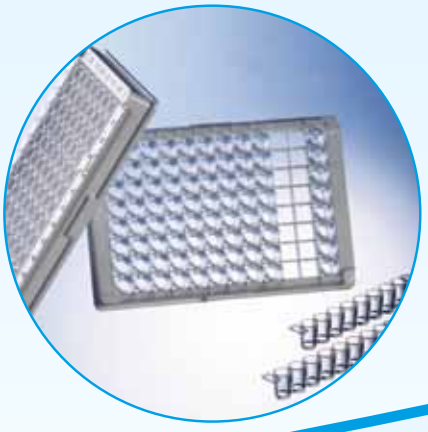


Upscaled Cell Culture

Immunology



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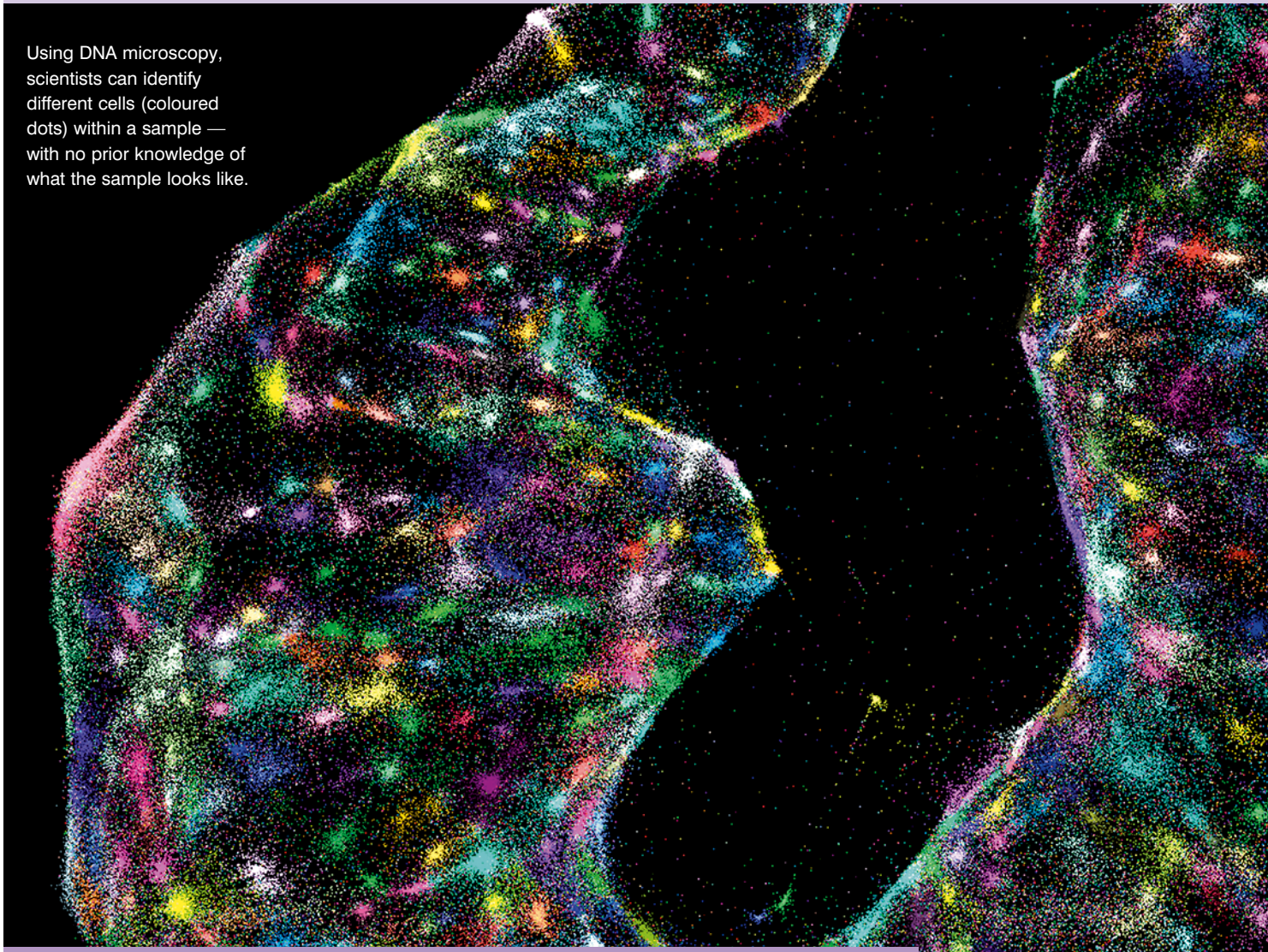


Using DNA microscopy, scientists can identify different cells (coloured dots) within a sample — with no prior knowledge of what the sample looks like.

DNA microscopy

— a new way to image cells

In an effort to image cells at the genomic level, US researchers have created an entirely new category of microscopy.

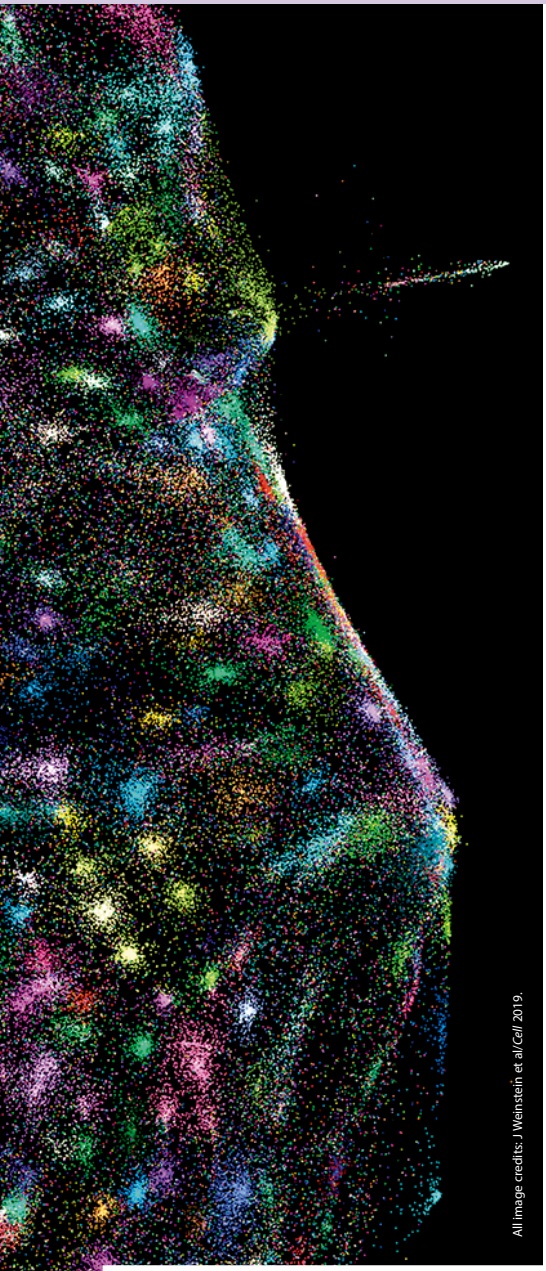
Traditionally, scientists have used light, X-rays and electrons to peer inside tissues and cells; these days they can trace thread-like fibres of nerves throughout the brain and even watch living mouse embryos conjure the beating cells of a rudimentary heart. Now researchers led by biophysicist Joshua Weinstein, from the Broad Institute of MIT and Harvard, have invented an unorthodox type of imaging dubbed 'DNA microscopy' that goes one step further — it can see what's happening in cells at the genomic level.

Instead of relying on light (or any kind of optics at all), the team uses DNA 'barcodes' to help pinpoint molecules' relative positions within a sample, helping scientists build a picture of cells and simultaneously amass enormous amounts of genomic information. Their work has been published in the journal *Cell*.

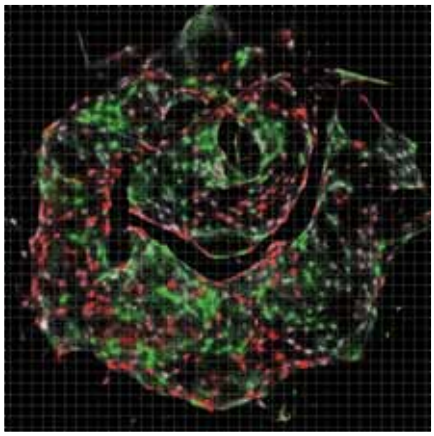
"It's an entirely new category of microscopy," said Howard Hughes Medical Institute (HHMI) investigator Aviv Regev, a co-author on the study. "It's not just a new technique, it's a way of doing things that we haven't ever considered doing before."

Until now, microscopy has fit into two main categories, the first of which is based on optics — electron microscopes, fluorescence microscopes and light-sheet microscopes are all based on the principle that samples emit photons or electrons, and the microscope detects the emission. The second category is based on dissecting samples at locations defined by a microscope, with computer programs then stitching together each dissected piece into a complete picture of the intact sample.

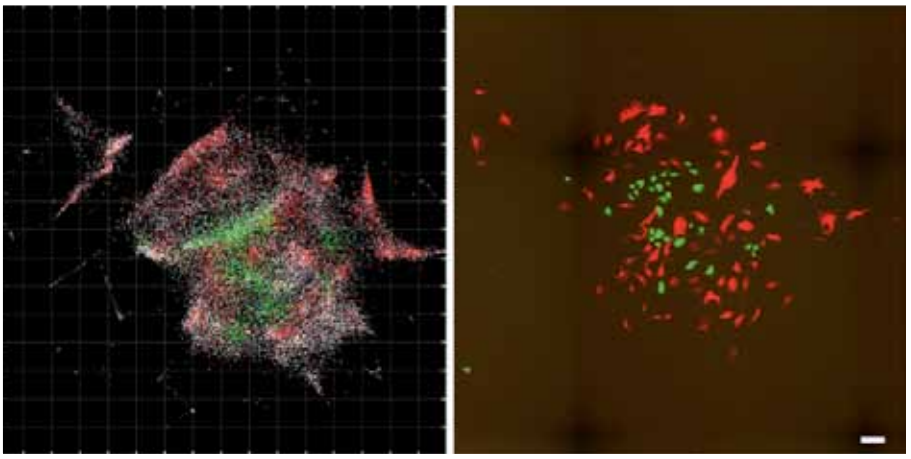
Optical imaging can offer intricate portraits of subcellular structure and action, while dissection-based microscopy can give scientists genetic



All image credits: J Weinstein et al/*Cell* 2019.



In this visualisation of data provided by DNA microscopy, resolution is comparable to optical imaging.



Using DNA microscopy (left), scientists can accurately reconstruct an image of cells captured with a fluorescence microscope (right). Scale bar = 100 μm.

Weinstein and his colleagues wanted to do it all in one shot — take a snapshot of a cell's position and spell out the specific genetic sequences driving it — a combination that is important for scientists studying genetically diverse sets of cells.

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The immune system is a perfect example, Weinstein said. Immune cell genes can vary down to a single letter of DNA. Each variation can trigger a dramatic shift in the type of antibodies a cell produces. Where that cell is located within a tissue can alter antibody production, too. If you focus on just one or the other, "you're only getting part of the picture", Weinstein said.

The good news, according to Regev, is that capturing a complete picture of a cell starts with a specimen and a pipette.

First, scientists take cells grown in the lab and fix them into position in a reaction chamber. Then, they add an assortment of DNA barcodes. These stick to RNA molecules, giving each a unique tag. Next, the team uses a chemical reaction to make more and more copies of each tagged molecule — a growing pile that expands out from each molecule's original location.

"Picture every single molecule as a radio tower broadcasting its own signal outward," Weinstein said.

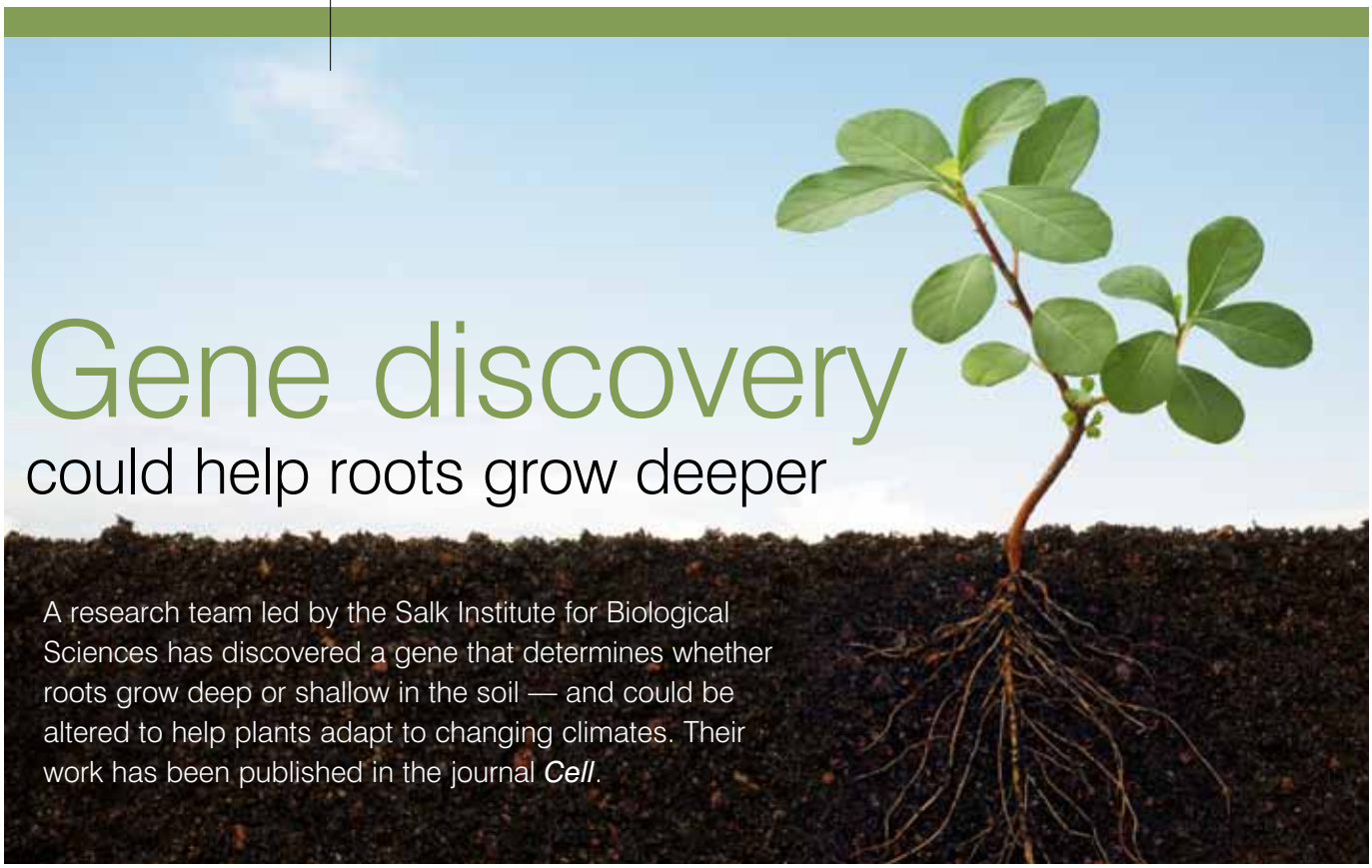
Eventually, the tagged molecules collide with other tagged molecules, forcing them to link together in pairs. Molecules located close to one another will be more likely to collide, generating more DNA pairs. Molecules further apart will generate fewer pairs.

A DNA-sequencing machine spells out the letters of every molecule within the sample, which takes up to 30 hours. An algorithm the team created then decodes the data — which, in the paper, represents roughly 50 million DNA letters of genetic sequences from each original specimen — and converts the raw data to images.

"You're basically able to reconstruct exactly what you see under a light microscope," Weinstein said. He added that the two methods are complementary — light microscopy can see molecules well even when they're sparse within a sample, and DNA microscopy excels when molecules are dense, even piled up on top of one another.

Weinstein thinks DNA microscopy could one day let scientists speed the development of immunotherapy treatments that help patients' immune systems fight cancer. The method could potentially identify the immune cells best suited to target a particular cancer cell, he said.

Regev added that the possibilities with this category of microscopy are wide open. He said, "We hope that it sparks the imagination — that people will be inspired with great ideas that we've never thought about."



Gene discovery
could help roots grow deeper

A research team led by the Salk Institute for Biological Sciences has discovered a gene that determines whether roots grow deep or shallow in the soil — and could be altered to help plants adapt to changing climates. Their work has been published in the journal ***Cell***.

In the new work, the researchers used the model plant thale cress (*Arabidopsis thaliana*) to identify genes and their variants that regulate the way auxin — a hormone that is a key factor in controlling the root system architecture — works. Though auxin was known to influence almost all aspects of plant growth, it was not known which factors determined how it specifically affects root system architecture.

"In order to better view the root growth, I developed and optimised a novel method for studying plant root systems in soil," said postdoctoral fellow Takehiko Ogura, first author on the study. "The roots of *A. thaliana* are incredibly small so they are not easily visible, but by slicing the plant in half we could better observe and measure the root distributions in the soil."

The team found that one gene, called *EXOCYST70A3*, directly regulates root system architecture by controlling the auxin pathway without disrupting other pathways. *EXOCYST70A3* does this by affecting the distribution of PIN4, a protein known to influence auxin transport. When the researchers altered the *EXOCYST70A3* gene, they found that the orientation of the root system shifted and more roots grew deeper into the soil.

"Biological systems are incredibly complex, so it can be difficult to connect plants' molecular mechanisms to an environmental response," Ogura said. "By linking how this gene influences root behaviour, we have revealed an important step in how plants adapt to changing environments through the auxin pathway."

The findings should allow researchers to develop plants that can help combat climate change as part of Salk's Harnessing Plants Initiative, which aims to grow plants with more robust and deeper roots that can store increased amounts of carbon underground for longer to reduce CO_2 in the atmosphere. The initiative will receive more than US$35 million from over 10 individuals and organisations through The Audacious Project to further this effort.

"We are incredibly excited about this first discovery on the road to realising the goals of the Harnessing Plants Initiative," said Associate Professor Wolfgang Busch, senior author on the paper. "Reducing atmospheric CO_2 levels is one of the great challenges of our time, and it is personally very meaningful to me to be working toward a solution."

In addition, the discovery could help scientists understand how plants address seasonal variance in rainfall and how to help plants adapt to changing climates. Busch said, "We hope to use this knowledge of the auxin pathway as a way to uncover more components that are related to these genes and their effect on root system architecture.

"This will help us create better, more adaptable crop plants, such as soybean and corn, that farmers can grow to produce more food for a growing world population."

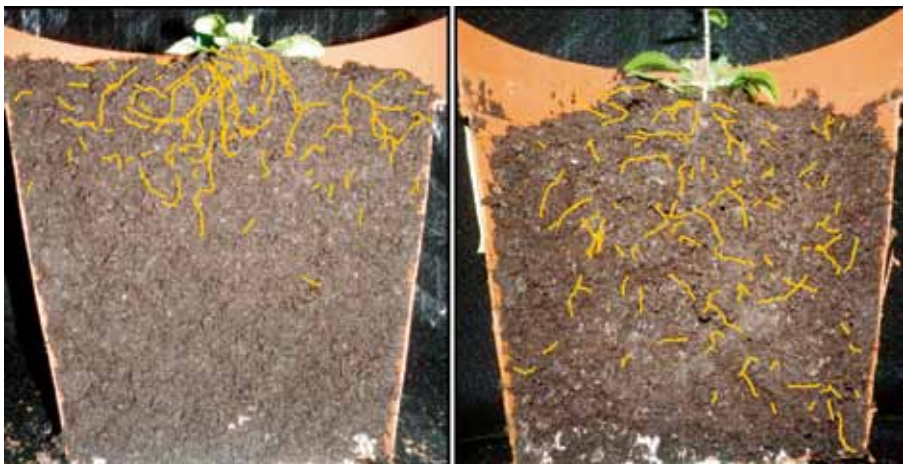


Image credit: Salk Institute.

Left: *Normal Arabidopsis thaliana* plant with shallow root system architecture. Right: *Arabidopsis thaliana* mutant showing deeper root system architecture. (Roots are coloured yellow for better visibility.)

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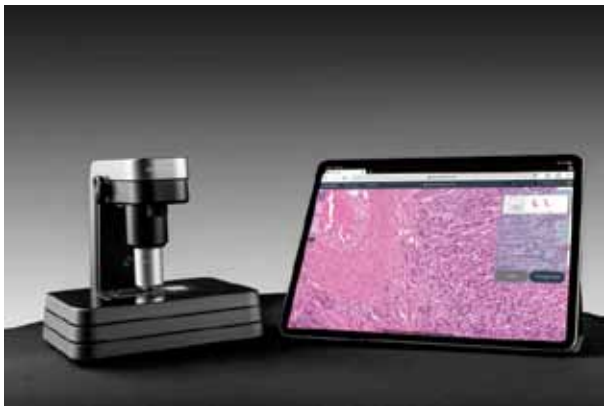

Portable whole slide imaging microscope

The Grundium Ocus portable whole slide imaging microscope removes the need for physical slide transfers between the clinic and the laboratory and enables live telepathology consultations between surgeons, pathologists, scientists and researchers practically anywhere on the planet, making it significant for the field of digital pathology. Field studies of the natural world can also be conducted on-site, examining plants, insects or anything else requiring microscopy for correct analysis.

The microscope is a precision tool designed to be small enough to be on every medical professional's desk. Featuring a 6 MP image sensor, it is portable and can be brought anywhere as it is compact and lightweight, weighing only 3.5 kg. It has multiple connectivity options for local and remote usage, and can be connected locally to a laptop, tablet or phone. It also has independent Wi-Fi and Ethernet support to enable direct internet connection, cloud support and remote access. It is easy to use, with a 500 GB internal hard drive, automated X Y stage with full (1″ x 3″) slide scanning, and an overview image option allowing automated trimming of areas to be scanned that are adjustable by the user.

The user can view, digitise, record and file microscope slides in-house, at their desk. The Grundium Ocus automatically stitches scanned images and saves them on the hard drive or swiftly exports them to cloud storage. When paired with a mobile phone, the image files can be immediately shared with colleagues in the laboratory or with an expert or researcher anywhere in the world. Slides can also be viewed in live mode on a larger screen. Specimens can also be viewed in Z-Direction to focus on the essential layer.

Digital pathology is enabled by whole slide imaging, which means converting traditional glass slides into digital files that can be viewed, managed and analysed on a computer monitor or shared in real time with colleagues all over the world, especially for a second opinion. WSI devices enable easier patient history recording and storage. Scanned samples become part of a patient's medical record and can be easily retrieved or shared for review.

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DURAN reagent bottles are designed and manufactured in Germany. Made of borosilicate glass, the bottles offer high chemical resistance with low thermal expansion, making them suitable for laboratory applications.

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The bottles come in the following sizes: 50, 100, 250, 500, 1000, 2000 and 5000 mL.

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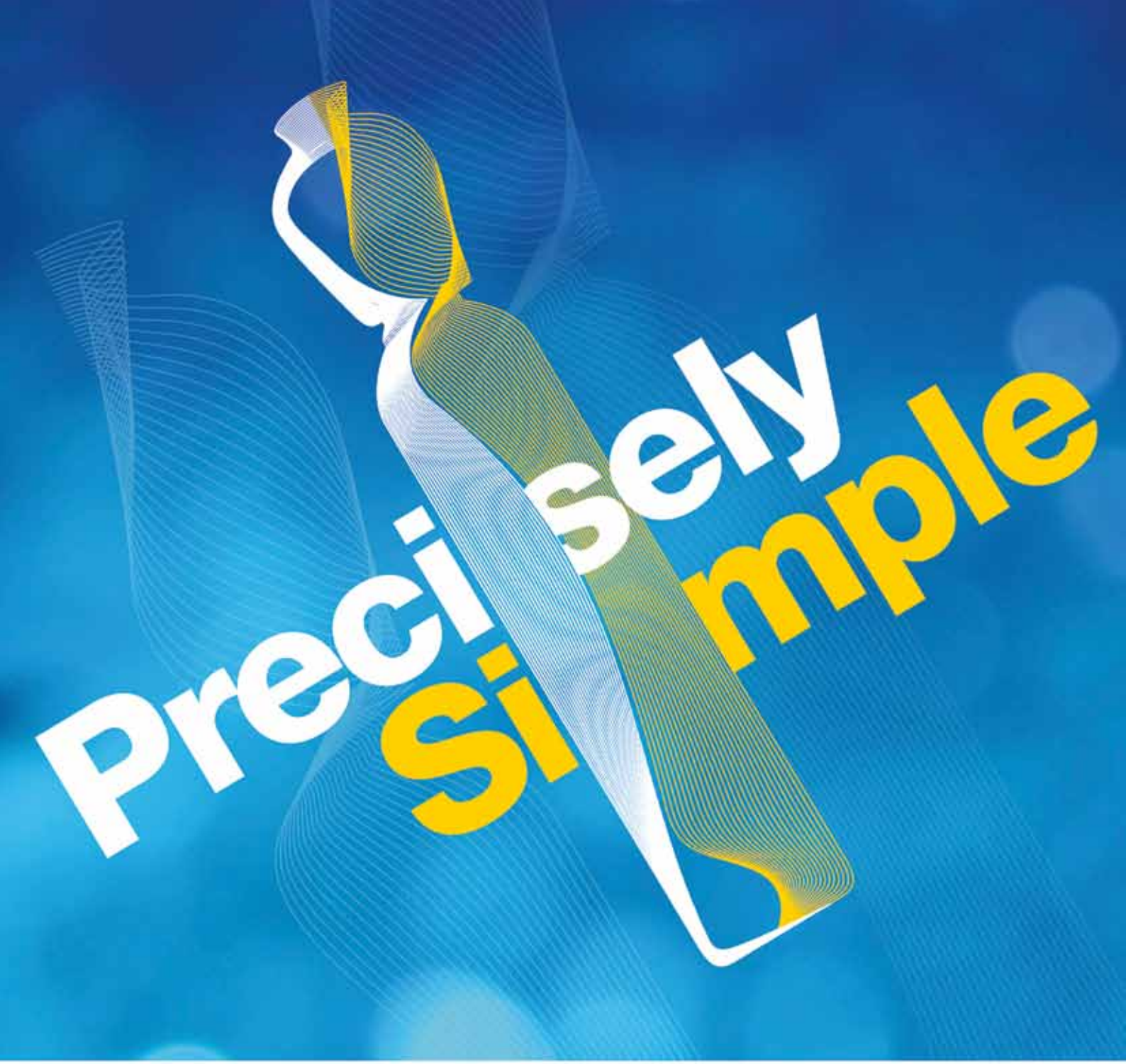

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Pre-plated automation kits and dual index barcodes

To simplify NGS library construction, the NEXTFLEX Rapid XP DNA-seq Pre-Plated Automation Kits and NEXTFLEX Unique Dual Index Barcodes are suitable for labs looking to maximise workflow efficiency with an automated library prep solution that is designed to be reliable, convenient and streamlined.

By leveraging these plug-and-play library construction kits automated on the PerkinElmer Sciclone G3 NGS/NGSx and Sciclone G3 NGSx iQ workstations, the time-consuming and error-prone plate set-up process is said to be eliminated, saving time, reducing costs associated with dead volume and reducing headaches from sample prep failure caused by human error.

The NEXTFLEX Rapid XP DNA-Seq Pre-Plated Automation Kit is designed to offer reliability by providing consistent fragmentation, robust library yields and high-quality sequencing data. It is a complete solution containing the fragmentation enzyme, clean-up/size selection beads and a streamlined protocol offering a combined fragmentation, end-repair and adenylation step.

The NEXTFLEX Unique Dual Index Barcodes offer multiplexing flexibility with up to 384 UDI barcodes available in a pre-plated format. Labs can experience the security of having carefully designed and rigorously quality-tested barcodes which mitigate index hopping, barcode misassignment and sample crosstalk. Additionally, each lot is functionally validated for index purity by sequencing.

For research use only. Not for use in diagnostic procedures.

PerkinElmer Pty Ltd
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Single-cell open chromatin sequencing assay

Bio-Rad Laboratories has launched its scATAC-Seq assay, which facilitates genome-wide open chromatin sequencing at the single-cell level, to help researchers better understand gene expression regulation.

The product harnesses Bio-Rad's ddSEQ Single-Cell Isolator to encapsulate thousands of cell nuclei into nanolitre-sized droplets to facilitate library preparation for ATAC sequencing. Unlike other products, it does not require separate assays to collect this information and does not require millions of cells as starting material due to its high capture efficiency.

The product offers users a good level of sensitivity by providing the highest number of unique sequencing fragments that map to the nuclear genome, ATAC peaks and transcription start sites. With a cell capture efficiency of up to 95%, it provides a powerful tool to help researchers understand the factors that shape cell differentiation and cell fate.

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

Lauren Davis

Image credit: Andrew Worssam

Biologics Innovation Facility opens at UTS

The University of Technology Sydney (UTS) has opened the doors of its new Biologics Innovation Facility (BIF) — a training and production facility that seeks to enable new biotech discoveries as well as to drive the jobs of the future.

The idea for the facility originally came from Ireland, where Professor Peter Ralph, Executive Director of the UTS Climate Change Cluster (C3), saw the positive impact of the National Institute for Bioprocessing Research and Training (NIBRT) — a world leader in the field of biopharma training — on industry and the economy. Prof Ralph explained, "This is what we had been talking about as a training facility at UTS, to transform Australian industries."

Now the idea has finally been brought to fruition, thanks to $1.2 million in funding from the National Collaborative Research Infrastructure Strategy, initial seed funding of $750,000 from the NSW Boosting Business Innovation Program, significant investment from UTS itself and a burgeoning partnership between the university and GE Healthcare — all resulting in a 430 m^2 underground facility focused on the emerging field of biologics.

A biologic drug is produced from living organisms or contains components of living organisms — it can be composed of sugars, proteins, nucleic acids or complex combinations of these substances, or may be living cells or tissues. Biologics have revolutionised the treatment of cancer and other diseases, including autoimmune diseases like rheumatoid arthritis.

The downside of biologics is that they are much more expensive to produce than drugs made from chemicals. The BIF hopes to help bring these

GE Healthcare Life Sciences' ÄKTA readyflux is an automated, single-use, tangential flow filtration system that is designed to minimise cross-contamination risk, reduce the need for cleaning and shorten the batch changeover time.

Australian biotech businesses now have access to a cleanroom and laboratory environment that supports the in-country development of their innovations.

All images credit: Andrew Worssam

Single-use technology employed at the facility is said to be capable of supporting a greater capacity of projects than similar stainless-steel laboratories, which require rigorous chemical cleaning of all equipment and revalidation of sterility between batches.

costs down by producing small volumes of new technology-based biologics, establishing what works and passing that knowledge on so that full-scale production systems can be designed. But before it can produce these new biologics, the BIF needs scientists to help create them.

"It's 'chicken and egg' — you don't have the trained staff to support the industry, and you don't have the industry to allow people to move forward," Prof Ralph said. "That's what we're trying to create here, that pool of trained staff to allow further expansion of the industry."

"Australia has a massive opportunity to lead in development of the next generation of biotech and precision medicines," added Professor Dianne Jolley, UTS Dean of Science. "The pharma/bioprocessing industry needs trained workforce and upskilling programs to meet changing needs and demand for the future. The flexibility of the Biologics Innovation Facility enables UTS to offer that training and research development."

The BIF houses a series of clean rooms and containment laboratories that are expected to transform professional training in Good Manufacturing Practice (GMP), the essential industry standard for the sector; it is thus also known as the GMP Lite facility. Here, laboratory and factory technicians will be trained in bioprocessing techniques, and their use in a GMP environment, to retain a future workforce for the growing number of biopharma players in Australia. The facility will also offer a suite of courses direct from the NIBRT as of January 2020 — the only South East Asian node to do so, according to Prof Jolley.

GE Healthcare meanwhile serves as commercial supplier of GMP research and production equipment for the BIF and even has its own space within — the GE Healthcare KUBio GMP-compliant prefabricated biomanufacturing facility, based on a 200 L process to produce monoclonal antibodies and other recombinant products. This area has the capability to use different mammalian expression platforms and has been futureproofed to accommodate an expansion to a 1000 L process.

"This facility is an ideal environment for both start-ups and established companies to scale and refine their processes," said GE Healthcare Life Sciences CEO Emmanuel Ligner.

Professor Hugh Durrant-Whyte, NSW Chief Scientist and Engineer, added that the BIF represents engagement between academia and industry, so it's not just about university research and university training. He said, "It's about engaging with industry, and engaging in training industry, and using that facility to prototype, to explore, to start to develop new products that industry are genuinely engaged in."

Other areas of focus for the BIF are expected to include:

- the development of novel algae-based products, underpinned by the expertise of C3;
- support for Australia's future biosecurity defence in response to pandemics and the need for alternative supply chains;
- the development of cost-effective drugs, innovative sustainable foods and nutraceuticals.

UTS Vice-Chancellor Professor Attila Brungs concluded that the BIF will help support the creation of jobs in highly skilled STEM-based industries, stating, "I expect this facility will be key to addressing local skills shortages and ensuring the brightest and most talented scientists and engineers stay locally, allowing Australia to capture a multibillion-dollar share of a rapidly expanding biologics market while also making real-world impact in the area of biologics.

"I am excited to see what can be achieved as biologic research begins to unlock some of the most complex healthcare issues facing our world."

> Laboratory and factory technicians will be trained in bioprocessing techniques, and their use in a GMP environment, to retain a future workforce for the growing number of biopharma players in Australia.

GE Healthcare Life Sciences equipment at the facility include a 200 L bioreactor capacity and purification train to support pilot development of therapies and neutraceuticals.

Disposable clear tips

Tecan has introduced a redesigned packaging format for its Tecan Pure liquid handling (LiHa) disposable clear tips. The more compact and lightweight packaging option has less dead space between tip racks, making it easier and more economical to transport, as well as reducing waste disposal costs.

By optimising the packaging, the product now contains 45% less plastic than the current Tecan Pure blister packs, supporting progress towards a more sustainable approach. The updated design — initially available for the 200 and 1000 µL Tecan Pure clear tips — makes tips easier to store, maximising use of laboratory space. The clear LiHa disposable tips range provides verified performance for a variety of pipetting activities that do not require capacitive liquid level detection (cLLD).

Tecan Australia
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Quantum microscope

KMLabs has introduced the QM Quantum Microscope for next-generation imaging and analysis, built on the company's coherent extreme ultraviolet (EUV) and vacuum ultraviolet laser (VUV) sources. The modular QM platform enables high-contrast, near-surface-to-subsurface coherent imaging at the nanoscale and can be configured for EUV ultrafast spectroscopy.

The imaging and analysis solution comprises a high-powered laser amplifier source, EUV or VUV wavelength conversion, a high-efficiency beamline tailored to the user's experiment, and imaging or other analysis endstations that can effectively cover the microscopy/spectroscopy landscape for nano-to-quantum materials.

Enabling tabletop-scale EUV microscopy, QM offers information complementary to SEM (nm-scale resolution) and AFM (surface profile) with elemental selectivity and the ability to probe dynamic processes. QM configurations can enable laboratory-based high-contrast imaging of composition and structure; study of mechanical properties of patterned films; deep understanding of materials properties; and functional characterisation of spintronic, 2D, and advanced electronic and aerospace materials.

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Bluetooth thermometers

Wireless connectivity from a thermometer/hygrometer directly to a smartphone provides the freedom to concentrate on other tasks while still monitoring temperature and humidity. H-B Instrument DURAC Bluetooth thermometers alert the user when set parameters have been exceeded, from as far away as 40 m.

Data logging-enabled models record hourly data for seven days, then maximum and minimum data for the next 23 days. Recorded data can be viewed in a chart, graph or calendar right on the phone when using data logging models. Data can be exported onto a computer, and the user can even plot information from up to six data loggers on one graph for direct comparison.

Verification models provide temperature readings without sample contamination by utilising a glass bead-filled bottle that mimics the sample. These are also useful for monitoring the temperature within equipment such as incubators and refrigerators. With thermometer-only devices, users of non-data logging models can view temperatures through the THERMSmart app or directly on the LCD screen for on-unit monitoring.

All models include a certificate of compliance indicating accuracy for four temperature points or four temperature and three humidity points, and multiple language instructions. They are individually serialised, CE marked and RoHS compliant.

Rowe Scientific Pty Ltd
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Two-door laboratory freezer

The 1361-litre Laboratory Freezer with electronic controller (LGPv 1420) is designed to offer safe and reliable cold storage for critical samples and reagents in PC2 facilities.

Critical samples and reagents can be optimally stored between -10°C and -26°C with temperature set to 1/10°C accuracy using the flush-mounted keypad on the high-tech electronic controller. The keypad can be locked to prevent temperature setting changes, and a physical lock protects samples and reagents against unauthorised access.

Refrigeration components are top mounted to comply with PC2 requirements, and functional parts like fans and evaporators are located outside the unit for servicing and to increase the net capacity of the freezer.

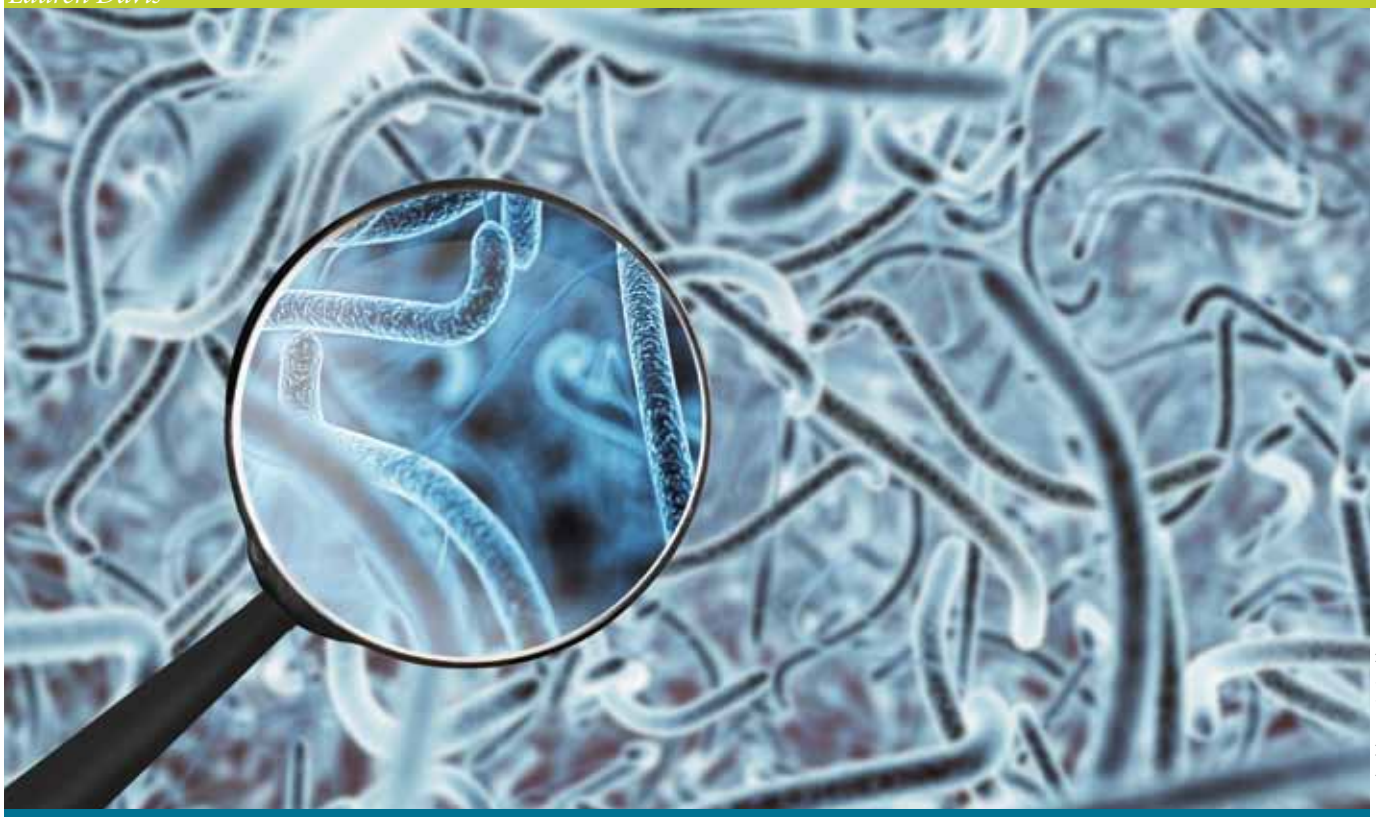
The 1361-litre laboratory freezer with electronic controller uses a forced-air cooling system for maximum temperature stability and fast recovery after door openings. The automatic and short (12 min) hot gas defrost cycle eliminates ice-build inside the freezer without compromising temperature and integrity of contents.

Castors allow the 1361-litre Laboratory Freezer with electronic controller to be easily moved for cleaning purposes or to reposition in the lab, and eight height-adjustable plastic-coated grid shelves help users maximise their storage capacity.

Visual and audible alarms warn users of temperature breaches and when door is ajar for more than 1 min, and a 72 h battery back-up monitors temperature in event of power outage. The freezer is also equipped with an access port for independent temperature sensors to be connected, a volt-free alarm contact and RS 485 interface for communicating temperature data, and alarms to remote monitoring or building management systems.

Andi-Co Australia
liebherrprofessional.com.au

Lauren Davis



Unhealthy microbiome linked to breast, colorectal cancer

Two separate studies have revealed the role played by the gut microbiome in the spread and detection of breast and colorectal cancer respectively. The results come just a couple of months after a worldwide collaboration demonstrated a causal link between the gut microbiome and the immune system's ability to fight cancer, further suggesting the importance of a healthy gut in combating the disease.

Most breast cancers (65% or more) are hormone receptor positive, which means their growth is fuelled by a hormone — either oestrogen or progesterone. Predicting whether such cancers will spread beyond the breast to other parts of the body is a major challenge, as early metastasis is affected by a variety of factors.

"One of them is having a high level of [immune] cells called macrophages present within the tissue," said Dr Melanie Rutkowski from the University of Virginia. "There have also been studies that have demonstrated that increased amounts of the structural protein collagen in the tissue and tumour also lead to increased breast cancer metastasis."

When Dr Rutkowski and her colleagues used powerful antibiotics to disrupt the microbiomes of mice with hormone receptor-positive breast cancer, they found this had dramatic effects in the body, priming the cancer to aggressively spread. The results of their study were published in the journal *Cancer Research*.

"It resulted in inflammation systemically and within the mammary tissue," Dr Rutkowski said. "In this inflamed environment, tumour cells were much more able to disseminate from the tissue into the blood and to the lungs, which is a major site for hormone receptor-positive breast cancer to metastasize.

"These findings suggest that having an unhealthy microbiome, and the changes that occur

within the tissue that are related to an unhealthy microbiome, may be early predictors of invasive or metastatic breast cancer. Ultimately, based upon these findings, we would speculate that an unhealthy microbiome contributes to increased invasion and a higher incidence of metastatic disease."

Dr Rutkowski emphasised that antibiotics are not dangerous and should not be avoided by women with breast cancer or anyone who needs them to treat infections; for this study, the antibiotics served only as a simple way to create a long-term imbalance to the microbiome, similar to what individuals may experience with chronically unhealthy microbiomes. The research does, however, suggest that doctors eventually may be able to manipulate the microbiome to benefit patients with breast cancer.

The key takeaway for now, Dr Rutkowski said, is the importance of a healthy microbiome, which can be achieved through a healthy, high-fibre diet, regular exercise and plenty of sleep. "If you do all of those things, in theory, you should have a healthy microbiome. And that, we think, is very much associated with a favourable outcome in the long term for breast cancer."

The news came just a few days after researchers from Osaka University reported that increases in specific microbiome organisms are linked to the malignancies associated with colorectal cancer, such as intramucosal carcinomas and polypoid adenomas. Their results, published in the journal *Nature Medicine*, reveal that these specific markers could help distinguish cases of colorectal cancer from healthy samples.

Colorectal cancer, the third most prevalent cancer globally, is a relatively slow-moving disease — meaning it takes a long period of time before reaching its final, fatal stages. Therefore, early detection is crucial to ensuring effective treatment.

Recent studies have shown that assessing the genetic changes in faecal samples can accurately reflect the status of the gut microbiome, and may be useful for the early diagnosis of diseases. Seeking to test their theory that colorectal cancer is in part a microbial disease, the Osaka researchers assessed the faecal samples from over 600 patients who underwent colonoscopy, looking to assess the characteristics of their gut microbiota and how they relate to colorectal cancer.

"Our results show that changes in the gut microbiome are present at the very early stages of colorectal cancer development, which could potentially provide vital diagnostic and causative clues for this disease," said Shinichi Yachida, a corresponding author on the study.

Another corresponding author, Takuji Yamada, added, "Our results revealed that colorectal cancer was linked to an increase in certain factors in the gut microbiome, as well as the presence of cancer-associated organisms. Future studies will focus on the relationship between the gut microbiome and tumour characteristics in individual patients with colorectal cancer. This will help us understand the roles of the microbiome in the development of colorectal cancer."

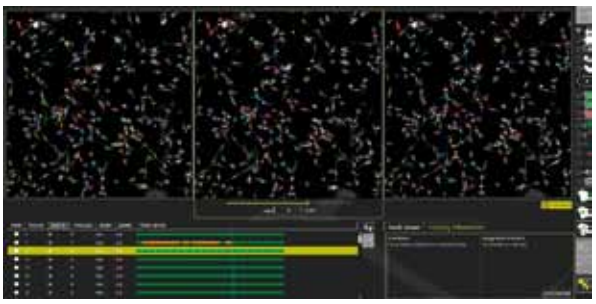
Go beyond traditional microscopy:

Livecyte 2 launched July 2019

Traditional label-free microscopy systems often fail to automatically identify individual cells due to lack of contrast, and while labelled techniques can produce high-contrast images, they ultimately perturb the cells and can be phototoxic. This can limit the type of cell that can be used and the duration that they can be imaged before measurement-induced cell behaviour changes emerge.

Livecyte is the only instrument for live cell research that uses Ptychography (Ptychographic Quantitative Phase Imaging) to capture images that measure the morphology and motion of cells, without the use of labels and at scale. Optimised for long-term, non-invasive monitoring of live cells, Livecyte allows robust automatic tracking and behavioural analysis of thousands of individual cells within heterogeneous cell populations. Unique morphological, temporal and dynamic phenotypic data make it simple to gain new biological insights and accelerate your research.

The latest compact **Livecyte 2**, launched July 2019, is packed with a bunch of new features and a savvy modular purchase structure, making it very interesting indeed.

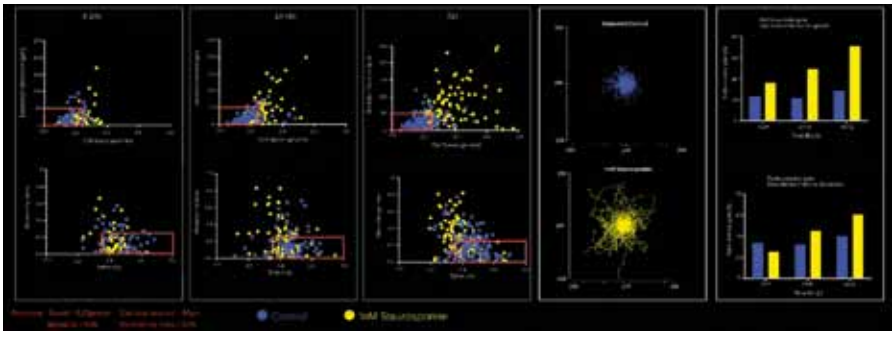


Screenshot of cell tracking software featuring 'track health', tools to edit and repair tracks along with suggested solutions.

Livecyte 2 Dashboards, providing intuitive representations of the complex measured data, are automatically generated. These Dashboards easily combine application specific unique sets of parameters, including a multipanel video, initial experimental conditions and the dynamic behaviour of the experimental parameters over time. This allows a user to quickly and intuitively reach valid conclusions relating to their experimental outcomes.

Automated Individual cell segmentation and tracking allows a phenotypic fingerprint to be assigned to every cell within large and complex populations (mixed cultures, heterogeneous populations). The continuous nature of acquisition enables detailed dynamic data on cell behaviour to be captured over time, together with morphological changes. This combination of parameters can be captured label-free. **Unique cell tracking refinement software** enables full lineage and cell fate tracing with fully quantitative metrics for every cell at every time-point.

A game changer to how cell motility is analysed is possible, scratch wounds can be replaced with **random motility** assays — thereby negating the requirement to insult the culture with a scratch, imposing an unnatural cascade. **Subtle changes in cellular phenotypes** can be elucidated by different kinetic data in cell populations previously unseen; consider a breast cancer cell line treated with a tonic stimulation of Staurosporine. The figure below shows a comparison between untreated and a 1 nmol Staurosporine treated MDA-MB-231 Cells. Changes in confluence and dry mass measurements demonstrate little variation between the two populations, whereas tracking the cell's **Meandering Index and Euclidean Distance** the phenotypic variation is exposed. It is clear the untreated cells are relatively immobile, whereas the low-dosed cells are far more active, highlighting the need to be rigorous in dose evaluation, given these are Metastatic Breast Cancer Cells.



Kasprowicz R et al 2017. Characterising live cell behaviour: Traditional label-free and quantitative phase imaging approaches (https://www.sciencedirect.com/science/article/pii/S1357272517300055?via%3Dihub). Republished under CC BY 4.0.

In Summary, **Livecyte 2** offers:

- High contrast imaging enabling segmentation & tracking plus metrics for individual cells and populations
- High content & Unique information — an Assay driven approach — Multiple outputs
- Label Free — non perturbing
- Cells are viable — even after up to 2 weeks — you can remove your cells post acquisition and continue their Culture, perhaps isolate a specific phenotype... **We have just borrowed your cells.**

Livecyte complements existing platforms — no Live cell imaging facility should be without the Livecyte 2.

For more information, please contact Peter Davis.

ATA Scientific Pty Ltd
pdavis@atascientific.com.au
Web: www.atascientific.com.au

Self-priming pumps

Alfa Laval's LKH Prime 40 is a hygienic, self-priming pump that offers high energy efficiency and versatility, as well as low noise levels and easy maintenance. The pump has the ability to reach a flow rate of up to 110 m^3/h and head of 115 m.

Using a combination of air-screw technology, optimised impeller and casing geometry, the pump offers efficient operation with low energy consumption and CO_2 footprint. Engineered to meet the stringent requirements of the hygienic industries, it is EHEDG certified and authorised to carry the 3-A symbol. It has been designed for cleaning-in-place (CIP) duties containing entrained air and can also pump product.

Quiet in operation, the device is claimed to reduce sound pressure levels by 80% when compared to traditional pump technologies for CIP/entrained air applications. The pump is easy to service and maintain.

LKH Prime UltraPure versions are also available for pharmaceutical applications.

Alfa Laval Pty Ltd
www.alfalaval.com.au

Decontamination services

BioSafety is a hygiene-based decontamination company providing equipment, service and consultation to the Australian and New Zealand life science, pharmaceutical, food and beverage and healthcare markets. The company provides biological and chemical decontamination equipment and services for routine or single-time events.

Whether it's for contamination response or preventive decontamination of new or existing facilities, applying ClorDiSys's method of using pure chlorine dioxide gas allows the company to completely decontaminate a facility all at once, with minimal equipment and minimal downtime. Gaseous systems provide the ability to achieve complete distribution and penetration to all surfaces within a facility, including cracks and crevices, which other methods (vapours, mists or fogs) cannot necessarily ensure.

According to BioSafety, only gaseous decontamination agents offer effective decontamination against life-threatening organisms in a non-ideal setting; these are thus the only agents that are effective in areas that are difficult to reach such as floor drains, HVAC grills, beneath furniture and components, inside of cabinets, hinges, instruments and components, and in other difficult-to-reach areas. Chlorine dioxide gas is non-carcinogenic, residue-free and said to be safer on materials than bleach, ozone, hydrogen peroxide and common liquid chlorine dioxide solutions.

BioSafety Pty Ltd
www.biosafety.com.au

Radio burst pinpointed 3.6bn light-years away

An Australian-led international team of astronomers has determined the precise location of a powerful one-off burst of cosmic radio waves, thanks to CSIRO's Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope in Western Australia.

The Milky Way galaxy stretches above the core group of CSIRO's ASKAP radio telescope.

Image credit: CSIRO, Alex Cherney.

The galaxy from which the burst originated was subsequently imaged by three of the world's largest optical telescopes — Keck, Gemini South and the European Southern Observatory's Very Large — with the results published in the journal *Science*.

As noted by CSIRO's Dr Keith Bannister, lead author on the study, "This is the big breakthrough that the field has been waiting for since astronomers discovered fast radio bursts in 2007." In the 12 years since then, a global hunt has netted 85 of these bursts — most have been one-offs but a small fraction are 'repeaters' that recur in the same location.

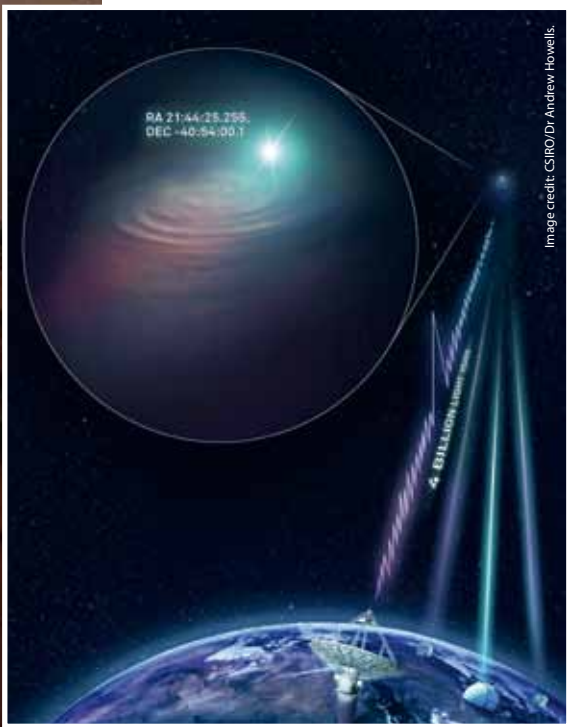


Image credit: CSIRO/Dr Andrew Howells.

RIght: Artist's impression of CSIRO's ASKAP radio telescope finding a fast radio burst and determining its precise location. The KECK, VLT and Gemini South optical telescopes joined ASKAP with follow-up observations to image the host galaxy.

In 2017 astronomers found a repeater's home galaxy, but localising a one-off burst has been much more challenging. Fast radio bursts last less than a millisecond, making it difficult to accurately determine where they have come from.

That all changed when Dr Bannister's team developed technology to freeze and save ASKAP data less than a second after a burst arrives at the telescope. This technology was used to pinpoint and map the location of FRB 180924 to the outskirts of its home galaxy (DES J214425.25?405400.81), located about 3.6 billion light-years away.

ASKAP is an array of multiple dish antennas and the burst had to travel a different distance to each dish, reaching them all at a slightly different time. Team member Dr Adam Deller, of Swinburne University of Technology, noted, "From these tiny time differences — just a fraction of a billionth of a second — we identified the burst's home galaxy and even its exact starting point, 13,000 light-years out from the galaxy's centre in the galactic suburbs."

Dr Bannister added, "If we were to stand on the Moon and look down at the Earth with this precision, we would be able to tell not only which city the burst came from, but which postcode — and even which city block."

To find out more about the home galaxy, the team imaged it with the European Southern Observatory's 8 m Very Large Telescope in Chile and measured its distance with the 10 m Keck telescope in Hawaii and 8 m Gemini South telescope in Chile. Dr Deller noted that the one-off burst and its home galaxy look nothing like the previous identified repeater, which comes from a very tiny galaxy that is forming lots of stars.

"[The new burst] comes from a massive galaxy that is forming relatively few stars," he said. "This suggests that fast radio bursts can be produced in a variety of environments, or that the seemingly one-off bursts detected so far by ASKAP are generated by a different mechanism to the repeater."

The cause of fast radio bursts remains unknown, but the ability to determine their exact location is a big leap towards solving this mystery.

"These bursts are altered by the matter they encounter in space," said team member Dr Jean-Pierre Macquart, from the Curtin University node of the International Centre for Radio Astronomy Research (ICRAR).

"Now we can pinpoint where they come from, we can use them to measure the amount of matter in intergalactic space." This would reveal material that astronomers have struggled for decades to locate.

"If we were to stand on the Moon and look down at the Earth with this precision, we would be able to tell not only which city the burst came from, but which postcode — and even which city block."

The S-Monovette® is the revolution in blood collection.

The S-Monovette is an innovative enclosed blood collection system that allows the user to draw blood from the patient using the syringe or vacuum method, uniting the advantages of both techniques in a single product.

When used as a syringe, the phlebotomist has full control over the speed at which the blood is drawn into the tube. This is particularly useful for patients with fragile veins, such as the very young or elderly, where the use of the aspiration technique prevents even the most fragile veins from collapsing. When the tube has been filled, the plunger is simply snapped off to leave a primary sample tube which can be centrifuged and is compatible with all major analysers.

The S-Monovette can also be used as an evacuated tube by drawing the plunger fully down and snapping it off immediately prior to blood collection. This creates a fresh vacuum and ensures a precise filling volume, ensuring a correct dilution ratio.

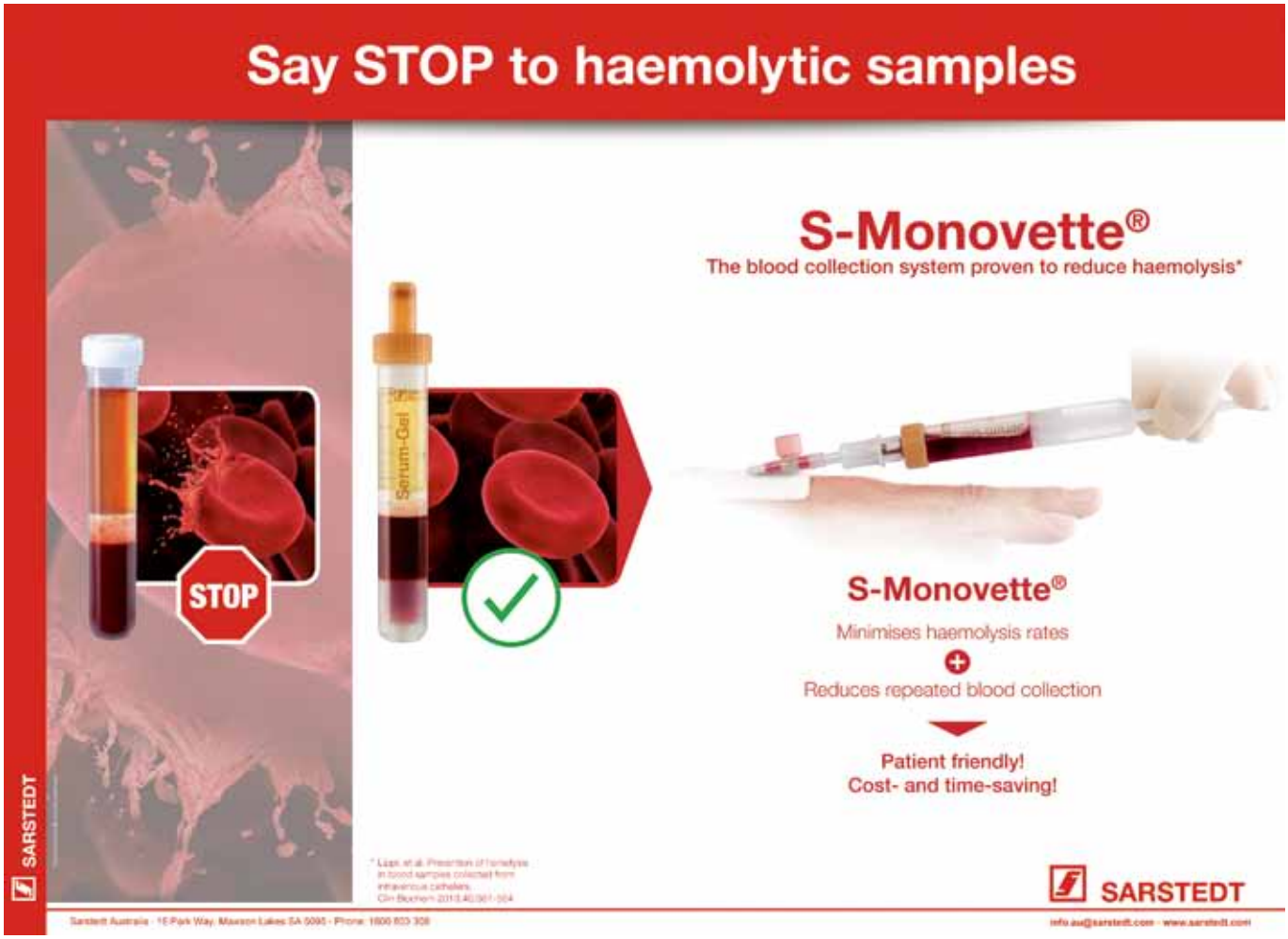
The reduced vacuum pressure in the S-Monovette drastically reduces the rate of haemolysis and vein collapse, meaning increased sample quality and reduced costs associated with repeat collections. Furthermore, unlike pre-evacuated tubes, the S-Monovette does not have to hold a vacuum for many months after manufacture, which allows the membrane stopper to be thinner and more easily penetrated by the needle sheath. This minimises the movement of the needle in the vein when attaching the tube, ensuring optimum patient comfort.

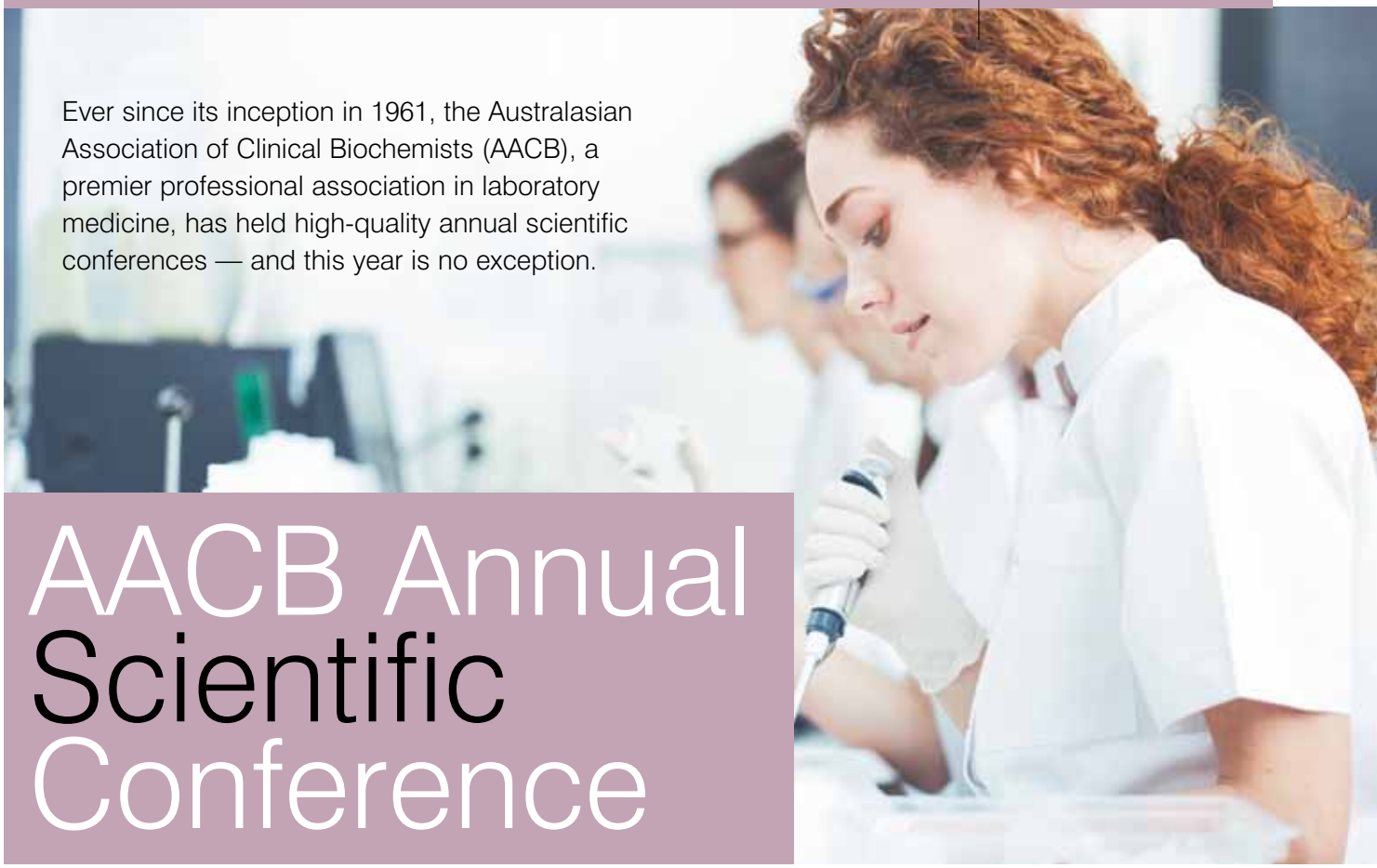
The S-Monovette needle is ready to use so that there is no need for assembly to a holder. The needle is of a compact, low profile design, which reduces the chance of haematoma by allowing for a reduced angle of puncture and eliminates the possibility of needle stick injury caused by assembly of the needle and holder. The compact design also results in approximately one sixth of the sharps volume caused by using a pre-evacuated system, giving significant cost savings.

If you would like a visit from one of our Sales Representatives to demonstrate this system, please contact us on **toll free 1800 803 308**.

SARSTEDT

Sarstedt Australia
www.sarstedt.com





Ever since its inception in 1961, the Australasian Association of Clinical Biochemists (AACB), a premier professional association in laboratory medicine, has held high-quality annual scientific conferences — and this year is no exception.

AACB Annual Scientific Conference

The 57th AACB Annual Scientific Conference will be held at Adelaide Convention Centre from 15–17 October. The theme of the 2019 conference is 'Clinical Biochemistry: Optimising Value in Healthcare'.

Current focus in many healthcare disciplines, including pathology, is turning to value for money for payers and maximising health outcomes for patients. This year's AACB conference aims to showcase how optimising use of clinical biochemistry and laboratory medicine can add value to laboratory testing by improving patient outcomes and enhancing the efficiency of the patient care pathway in addition to maintaining quality performance. The program will not only investigate the 'value proposition' in terms of cost-effectiveness, it will also explore recent biomarker discovery and implementation in clinical laboratories and beyond that leads to improved patient outcomes.

This year's David Curnow Plenary Lecture will be delivered by Dr Andrew St John, who is the Chair of Committee for the Value Proposition in Laboratory Medicine for the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), a member of the European Federation of Laboratory Medicine Test Evaluation Working Group (EFLM-TEWG) and a past president of the AACB. He is a leading Perth-based clinical scientist and consultant in laboratory medicine and pioneer of the application of the value proposition, a concept well known in business, to laboratory medicine. His lecture, titled 'Sustainable Healthcare: Is Quality Pathology the Key?', will explore the value proposition and describe how adoption of this will necessitate the pathology profession providing leadership for research across health care to demonstrate the value of pathology.

There will also be two international speakers delivering plenary lectures at this year's conference.

Dr Christa Cobbaert heads the Department of Clinical Chemistry and Laboratory Medicine at Leiden University Medical Center (LUMC). She is Vice-Chair of the IFCC Scientific Division Executive Committee and the current Chair of EFLM-TEWG. Her plenary lecture will be based on her experience of redesigning the 24/7 core lab and the total diagnostic test processes (including the underlying IT process) at LUMC using a system engineering approach, and how this has improved patient outcomes.

Laboratories do not operate in a vacuum and scientists are required to do more with less on a daily basis. In his plenary, Dr Paul Jüelicher will describe how to translate laboratory information into what he describes as "health authorities' and managers' endpoints". Dr Jüelicher is a leading authority in health-based economics and is also a member of the IFCC's Committee on the Value Proposition in Laboratory Medicine.

Other conference highlights include lectures given by Professor Rita Horvath and Alison Smith. Prof Horvath will talk about the evidence- and risk-based approach to effective communication of high-risk laboratory results — this will reflect work done in the RCPA-AACB Critical Laboratory Results Working Party as well as the CLSI and RCPA-AACB high-risk results guidelines. Smith will be expand on defining test value based on outcomes and bridging the health technology assessment (HTA)–laboratory divide.

Symposium themes in the main conference include advances in care delivery in lipid disorders, paediatric biochemistry, endocrinology and informatics.

Two satellite meetings have also been scheduled. On Monday, 14 October there is a 'Point of Care Testing Workshop' and on Friday, 18 October there is the next instalment of the popular 'Quality Control Workshop'.

The conference organisers look forward to welcoming attendees to Adelaide in October.

What: 57th AACB Annual Scientific Conference
When: 15–17 October 2019
Where: Adelaide Convention Centre
Web: https://www.aacb.asn.au/eventsinfo/aacb-57th-annual-scientific-conference

Erythroferrone (human) ELISA kit

AdipoGen's Erythroferrone (human) ELISA Kit is a sandwich assay based on two antibodies for the in vitro quantitative determination of human erythroferrone in cell culture supernatants, serum and plasma.

Erythroferrone (also called Myonectin, CTRP15, Fam132B or ERFE) is a hormone produced by erythroblasts in the bone marrow in response to erythropoietin, therefore controlling iron storage levels. It also acts as a myokine, abundantly expressed in skeletal muscle tissue, which is upregulated in response to exercise. Erythroferrone is a potential clinical biomarker for assessing erythropoiesis in patients with blood disorders, iron homeostasis and metabolic disorders.

The levels of erythroferrone measured by the ELISA kit in serum and plasma correspond to erythroferrone mouse protein levels (~500 ng/mL). The kit is highly specific and has a high sensitivity of 270 pg/mL.

Sapphire Bioscience
www.sapphirebioscience.com

4K microscope camera

The ZEISS Axiocam 208 color is a fast, 8 MP, 4K microscope camera for smart digital documentation. Featuring full 4K resolution in 30 fps, it offers sharp colour rendering and includes live image enhancement functions like sharpening, denoising and HDR.

The product can be used in standalone mode with images saved on a USB flash drive, or as part of the Labscope imaging app or ZEN imaging software. It is compatible with USB 3.0, Ethernet and Wi-Fi, with the Labscope app able to control the camera wirelessly.

The camera provides easy and effortless digital documentation, with users documenting samples as they see them in the eyepieces. This makes it especially suitable for education, digital classrooms and routine documentation.

The device can connect directly to a monitor via an HDMI cable for live image display for search, focusing and review of acquired images. Standalone operation sees the camera controlled by the intuitive on-screen display via mouse and keyboard, without a PC.

Carl Zeiss Pty Ltd
www.zeiss.com.au

Vaccine and pharmacy refrigerators

The Liebherr Vaccine & Pharmacy Refrigerators are specifically designed to store vaccines and are Quality Care Pharmacy Program compliant for peace of mind.

Factory set to +5°C and with alarms set to +2°C and +8°C, the refrigerators operate within the recommended temperature range for vaccines and require no temperature adjustment out of the box for user convenience and compliance. An in-built safety thermostat also prevents temperature dropping below +2°C to protect vaccines from freezing.

The high-performance forced-air cooling system and circulation of air within the Liebherr Vaccine & Pharmacy Refrigerators provides a stable and consistent internal temperature and, working in conjunction with the efficient compressor, offers good temperature recovery after the door has been opened. Upright and under-counter vaccine and pharmacy refrigerators are available to suit different spaces within, and the vaccine storage needs of facilities.

The Liebherr Vaccine & Pharmacy Refrigerators have a number of safety features, including audible/visual alarms to alert users of temperature breaches and if door left open; an onboard data memory to log min/max temperature and alarm events; an evaporator cover to prevent vaccines from touching cooling plate and freezing; a keypad lock to prevent temperature and alarm settings from being changed without a pass code; and a physical lock to protect against unauthorised access.

The refrigerators also come with a data logger for independent temperature monitoring.

Andi-Co Australia
liebherrprofessional.com.au

Universal lateral flow assay kit

For the fast and easy development of customised lateral flow assays, Expedeon's Universal Lateral Flow Assay (LFA) Kit is designed to enable the easy development of customised sandwich lateral flow assays.

The advantage of the kit is its adaptability to any pair of capture and detection antibodies, which allows the detection of any type of analyte without the need to spray down capture antibodies on the test strip — a labour-intensive process that consumes large amounts of expensive antibody reagent. The antigen just needs to contain at least two antigenic sites for the binding of the capture and detection antibodies.

The kit combines Expedeon's easy-to-use Lightning-Link Antibody Labeling Kits and InnovaCoat GOLD Nanoparticle Conjugation technologies with an immunochromatographic test performed on Universal LFA strips. The capture antibody is conjugated to Lightning-Link Ulfa-Tag while the detection antibody is conjugated to 40 nm InnovaCoat GOLD, both of which require only 30 s to set up. This makes the kit quick and easy to use.

The assay is compatible with biological samples, so there are no false negative results. Qualitative and quantitative analysis are made possible using the supplied scoring card or an LFA reader respectively. No specialised equipment is necessary.

BioNovus Life Sciences
www.bionovuslifesciences.com.au

Image credit: SA Water.

AWQC Method Development Coordinator Gary Hallas using the Ion Chef DNA technology.

DNA technology used to detect *E. coli* in our water

SA Water scientists from the Australian Water Quality Centre (AWQC) are using DNA technology to quickly differentiate between climate-influenced non-infectious bacterial blooms and potentially dangerous *E. coli* bacteria, in order to help maintain public health and safeguard Australia's water supplies.

A common bacterium found in human faeces, *E. coli* has long been a potential contaminant to waterways and catchments, posing a risk for gastrointestinal illness if not detected and treated by SA Water and other utilities. This practice has been made more challenging for water treatment operators over recent years with the proliferation of a different, potentially climate-evolved bloom *E. coli*, which does not pose a risk to human health but can mask its more dangerous counterpart.

"The prevalence of thermotolerant bloom *E. coli* has been an increased issue for water utilities across Australia, which we speculate is potentially due to Australia's changing climate and water conditions, allowing for an evolution link and gene transference mechanism between common bacteria in our open water sources and our indicator organism for risk management," said AWQC's Method Development Coordinator, Gary Hallas.

"Through a new thermotolerant culturing process and then identifying the unique *E. coli* DNA sequence-types, we can clearly differentiate the make-up of both naturally blooming and potentially pathogenic faecal *E. coli* within just a few hours and, most importantly, if any samples are of human health concern."

The new method utilises a unique thermotolerant agar culture developed by Hallas and the AWQC. Using the Ion Chef and the Ion S5 analytical equipment from Thermo Fisher Scientific, the DNA from the samples is placed on a DNA chip with unique barcodes identifying the problematic *E. coli* found in water samples. This is said to provide more detailed and reliable information than ever provided before in routine use by water laboratories around Australia.

"This is groundbreaking research for water quality management in Australia, as despite not posing risk to the human body, non-faecal *E. coli* has the potential to mask a true contamination event should it ever arise," said Hallas.

"Much like tracing a DNA fingerprint, we can also use the Ion Chef and Ion S5 to identify unique characteristics in the water samples, which allows us to track and monitor its presence over time at a single location or its movement through the network.

"We are the only water utility in the country regularly using this software to sequence specific *E. coli* DNA, and SA Water is at the forefront in helping other utilities across the water industry to identify and manage blooms in their water sources to prevent potential waterborne illness."

SA Water
www.sawater.com.au

Analytical tool for bioparticle characterisation

For over two decades, the Malvern Zetasizer range has helped improve product quality and stability of a wide range of particles and biomolecules and protein-based drug formulations. Using dynamic light scattering (DLS), the Zetasizer offers an easy-to use, flexible sizing method which is rapid and repeatable. It requires only small volumes of sample for analysis, and is non-destructive. Patented non-invasive back-scatter (NIBS) technology combines backscatter detection with variable measurement positioning to increase the range of sample concentration and size that can be measured, compared to conventional DLS.

Built on the Zetasizer Nano range, the Zetasizer Pro and Ultra systems from Malvern Panalytical are the latest iteration of the Zetasizer series. Several powerful capabilities have now been integrated into the range.

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 fast, high-precision measurements may be achieved with less need for filtering of samples and dispersants.

A key differentiator of the Zetasizer Ultra is its patented multi-angle dynamic light scattering (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 disposable capillary sizing cell provides non-destructive, low volume (3 μL) analysis, extending the upper range to 10 μm and delivering high-quality data.

The Zetasizer Pro and Ultra systems are controlled by ZS Xplorer deep learning software, introducing 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.

ATA Scientific Pty Ltd
www.atascientific.com.au

AGTA Annual Conference

The AGTA Annual Conference covers all aspects of genomic science, technologies and their applications.

This year's event will cover a range of topics, including cancer genomics, clinical genomics, epigenetics, the microbiome, new technology, plant genomics, population genetics and transcriptomics.

The AGTA (Australasian Genomic Technologies Association) 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 Australasian 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.

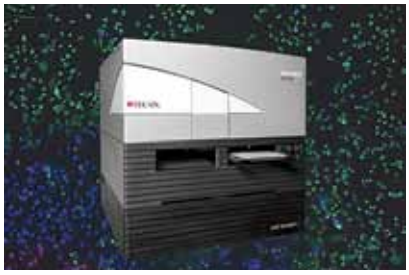
Keynote speakers:

- Andrew Adey, Oregon Health & Science University, USA
- Andrea Bild, City of Hope, USA
- Evan Eichler, University of Washington, USA
- Gosia Trynka, Wellcome Sanger Institute, UK
- Julie Law, Salk Institute for Biological Studies, USA
- Michael Schatz, John Hopkins University, USA

Invited speakers:

- Mark Cowley, Children's Cancer Institute, Aus
- Vijay Dhanasekaran, Monash University, Aus
- Kay Hodgins, Monash University, Aus
- Melissa Little, Murdoch Children's Research Institute, Aus
- Jose Polo, Monash University, Aus
- Alex Swarbrick, Garvan Institute of Medical Research, Aus
- Deborah Williamson, University of Melbourne, Aus

What: AGTA 2019 Annual Conference
When: 7–9 October 2019
Where Pullman Melbourne Albert Park
Web: https://agtaconference.org/



Live cell plate reader

Tecan's Spark Cyto is claimed to be the first live cell plate reader to offer real-time detection and analysis of biological, chemical and physical events — capturing the maximum amount of data from every well, at the same time and under the same conditions. Building on the original Spark platform, it combines the flexibility of a high-end multimode plate reader with whole well imaging and comprehensive environmental control for cell-based assays.

The product uses high-quality camera components and an LED autofocus system to provide real-time data acquisition and analysis for 6- to 384-well formats, ensuring that no key event is missed. It allows qualitative and quantitative information to be integrated into multiparametric data sets, delivering meaningful insights quickly. With three magnification levels and four acquisition channels, it enables entire cell populations to be investigated by capturing the whole well area of 96- or 384-well microplates in just one image, without tiling or distortion.

Powerful SparkControl and Image Analyzer software give the operator complete control of all experimental parameters, with predefined methods for common cytometry applications. Together with user-programmable advanced features — such as Real Time Experimental Control (REC) for automatic performance of kinetic experiments — this unlocks more possibilities for cell-based research.

Tecan Australia
www.tecan.com.au

Scratch assay starter kit

BioTek Instruments enhances cell biology workflows with the introduction of the Scratch Assay Starter Kit for use with its Lionheart Automated Cell Imagers and Cytation Cell Imaging Multi-Mode Readers. The starter kit includes the AutoScratch Wound Making Tool, Scratch App software, sample packages of 24- and 96-well microplates, and cleaning reagents.

When using the kit in kinetic cell migration and invasion scratch wound assays, AutoScratch automatically creates repeatable scratches of equivalent size and area in confluent cell monolayers to increase consistency and facilitate normalisation across subsequent assays. Interchangeable manifolds facilitate processing in 24- and 96-well microplates, and AutoScratch easily fits into laminar flow hoods.

The USB-supplied Scratch Assay App software includes predefined protocols to automatically calculate key wound healing assay statistics such as wound width, percent confluence and maximum healing rate.

The supplied 24- and 96-well microplate sample packs and cleaning reagents enable hands-free workflow convenience while ensuring optimal scratch assay performance and analysis.

Millennium Science Pty Ltd
www.mscience.com.au

‘Fingerprint’ spectroscopy in real time

To guarantee high-quality pharmaceuticals, manufacturers need not only to control the purity and concentration of their own products, but also those of their suppliers. Researchers at the Fraunhofer Institute for Applied Solid State Physics IAF have developed a measuring system capable of identifying a wide variety of chemical and pharmaceutical substances remotely and in real time, suitable for use in the pharmaceutical, chemical and food industry.

For pharmaceutical and food productions, continuous control of ingredients is indispensable. Usually, this would be done by sampling and a laboratory analysis via chromatography or spectrometers. However, such a process is time-consuming and allows only for spot checks. At Fraunhofer IAF, researchers have developed a measuring system capable of quality control in real time, identifying even the smallest amounts of substances based on their molecular composition.

Real-time measurements with quantum cascade lasers

The core of the system is an extremely fast tunable quantum cascade laser (QCL) operating in the mid-infrared range. Based on backscattering spectroscopy, the laser system not only identifies small amounts of chemical substances in real time, but also continuously controls chemical reaction processes.

“Our measuring system allows for a remote identification of a wide variety of chemical and pharmaceutical substances,” said Dr Marko Härtelt, a researcher at Fraunhofer IAF. “Time-consuming measurement procedures in laboratories can be replaced by real-time measurements during ongoing production processes.”

Together with his colleagues, Dr Härtelt has been working on the development of QCLs for infrared spectroscopy for several years now. With the help of researchers of Fraunhofer IPMS, he has developed a compact and robust laser source with which the whole wavelength range of the QCL emitter can be scanned within a millisecond. The basis for this ‘fingerprint’ method is the mid-infrared range (4–12 µm).

“Many chemical compounds have a unique absorption behaviour in this wavelength range, which is as unique as a human fingerprint,” said Dr Härtelt. The wavelength range enables a clear identification of the nature and composition of molecular compounds.

Extremely variable scan speed

Quantum cascade lasers developed by Fraunhofer IAF are characterised by their extremely variable scan speed and their compact size, as well as being widely tunable. The researchers have developed a QCL that can be tuned to work at high scan frequencies or in a quasi-static mode over a wide wavelength range. This is achieved through the combination of quantum cascade lasers in an external resonator with different MOEMS-based lattice scanners that work as wave selective elements.

“The fastest spectrally tunable resonant MOEMS scanners allow for the scanning of 1000 complete IR ranges per second,” said Dr Härtelt. “The high scanning speed is essential for applications in which the conditions change rapidly, such as the surveillance of chemical reaction processes or moving objects.”

QCL-based measuring systems are suitable for quality control at a variety of industrial sectors, thanks to their ability to identify various chemical substances remotely and in real time. Used in the pharmaceutical, chemical and food industry, the measuring systems provide information about the authenticity and purity of substances at any given time during the production process. Furthermore, the quantum cascade lasers can be used in medical diagnostics or in the security sector to test hazardous substances. Additionally, the compact design allows for the development of mobile, and even handheld, measuring systems.

26 MP resolution global shutter sCMOS camera

The PCO.edge 26 sCMOS camera features a true charge domain global shutter which allows for low readout noise and dark current. Its adjustable cooling functionality enables users to extend their exposure times by up to 60 s.

It offers ultrahigh resolution of 5120 x 5120 pixels, with 2.5 x 2.5 μm^2 pixel size, and maximises the level of information a user is able to derive from any one image. Applications include microscopy imaging with low magnification, quality control, SMLM DNA Origami, high-throughput screening and other mesoscopic functions.

Maximising the amount of information per image is crucial for microscopy, and this is where the PCO.edge 26 is advantageous. It offers frame rates of 7 fps @ 26 MP, exposure times of 5 μs to 60 s, and adjustable cooling from -20 to +20°C Peltier with forced air (fan) and water cooling. The data interface is USB 3.1 Gen1 and it has a dynamic range of 66 dB. It has a compact design and offers up to 65% quantum efficiency.

SciTech Pty Ltd
www.scitech.com.au

Benchtop microphysiological system

The PhysioMimix microphysiological system (MPS) is a suitable alternative to traditional in vitro experiments requiring animal models which are said to have inherent flaws and regulatory issues. PhysioMimix provides human-relevant data including comprehensive, 3D tissue culture-based data with real-time monitoring and analysis, allowing users to progress their research to clinical trials.

The lab benchtop device can be used to perform single- or multi-organ studies. Its open-well plate design enables the formation of three-dimensional microtissues that mimic the structure and function of human organs. Precise control of the fluidic environment can reveal how multiple organs interact and respond to drugs or other chemicals.

Cells and media can be sampled throughout experiments for analysis, including biomarker assays as well as imaging to visualise cell morphology, cell migration and protein marker localisation. Using this data, users can improve the efficiency of preclinical studies or industrial screening that require human-relevant data, according to the company.

Researchers in biopharma, academic and regulatory laboratories are using the platform to study primary cells, stem cells and organ mimetics in the liver, lung, gut, heart, kidneys, skin, endometrium and brain. PhysioMimix is also being used to conduct organ-on-chip assays.

AXT Pty Ltd
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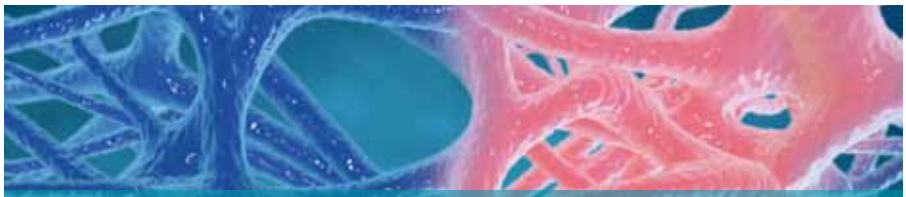

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14th World Congress on Inflammation

September 15–19, Sydney

With inflammation lying at the heart of almost all disease, WCI 2019 will enable attendees to engage with clinicians, industry representatives and biomedical researchers working across a diverse range of diseases, biological systems and technologies. The event will cover all aspects of inflammation, including fundamental molecular and cellular processes controlling inflammatory responses; preclinical models of inflammation-related diseases; new drug targets and biomarkers in human disease; genetics of disease susceptibility and drug responsiveness; and new technologies in inflammation research. There will also be a free public talk from science journalist and documentary maker Dr Michael Mosley on obesity and depression.

https://www.wci2019.org/

SAFETYconnect 2019
August 28–29, Melbourne
https://www.safety-connect.com.au/

2nd Australasian Exploration Geoscience Conference
September 2–5, Perth
https://2019.aegc.com.au/

ASCIA 2019 Conference
September 3–7, Perth
https://www.ascia2019.com/

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

7th Annual Heavy Ion Accelerator Symposium on Fundamental and Applied Science
September 9–13, Canberra
http://hias.anu.edu.au/2019/

19th Biennial Meeting of the International Council for NIR Spectroscopy
September 15–20, Gold Coast
http://www.nir2019.com/

International Conference on Materials Science and Engineering
September 16–18, Melbourne
https://www.materialsconferenceaustralia.com/

IUMRS-ICA 2019
September 22–26, Perth
https://iumrs-ica2019.com/

Australian Society for Biochemistry and Molecular Biology Conference
October 1–3, Perth
https://asbmb2019.com.au/

19th Annual AGTA Conference
October 7–9, Melbourne
https://agtaconference.org/

Melbourne ACS 2019
October 13–16, Melbourne
https://acs2019.org.au/

AABC 57th Annual Scientific Conference
October 15–17, Adelaide
https://www.aacb.asn.au/eventsinfo/aacb-57th-annual-scientific-conference

AusBiotech 2019
October 30–November 1, Melbourne
https://www.ausbiotechnc.org/

Australian Laboratory Management Conference 2019
November 11–13, Sydney
http://www.labmanagers.org.au/

COSA Annual Scientific Meeting
November 12–14, Adelaide
https://www.cosa.org.au/events/annual-scientific-meeting/

5th International Symposium on the System of Radiological Protection
November 17–21, Adelaide
https://icrp2019.com/

Australian Graphene Industry Association Conference 2019
November 19, Melbourne
https://grapheneindustry.org.au/conference/

14th GeneMappers Conference 2019
November 20–22, Sydney
https://www.neura.edu.au/event/genemapperconference2019/

12th Australian and New Zealand Society for Magnetic Resonance Conference
November 25–28, Naturaliste, WA
http://www.anzmag2019.com/

TeV Particle Astrophysics 2019
December 2–6, Sydney
https://indico.cern.ch/event/828038/overview

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Printed and bound by
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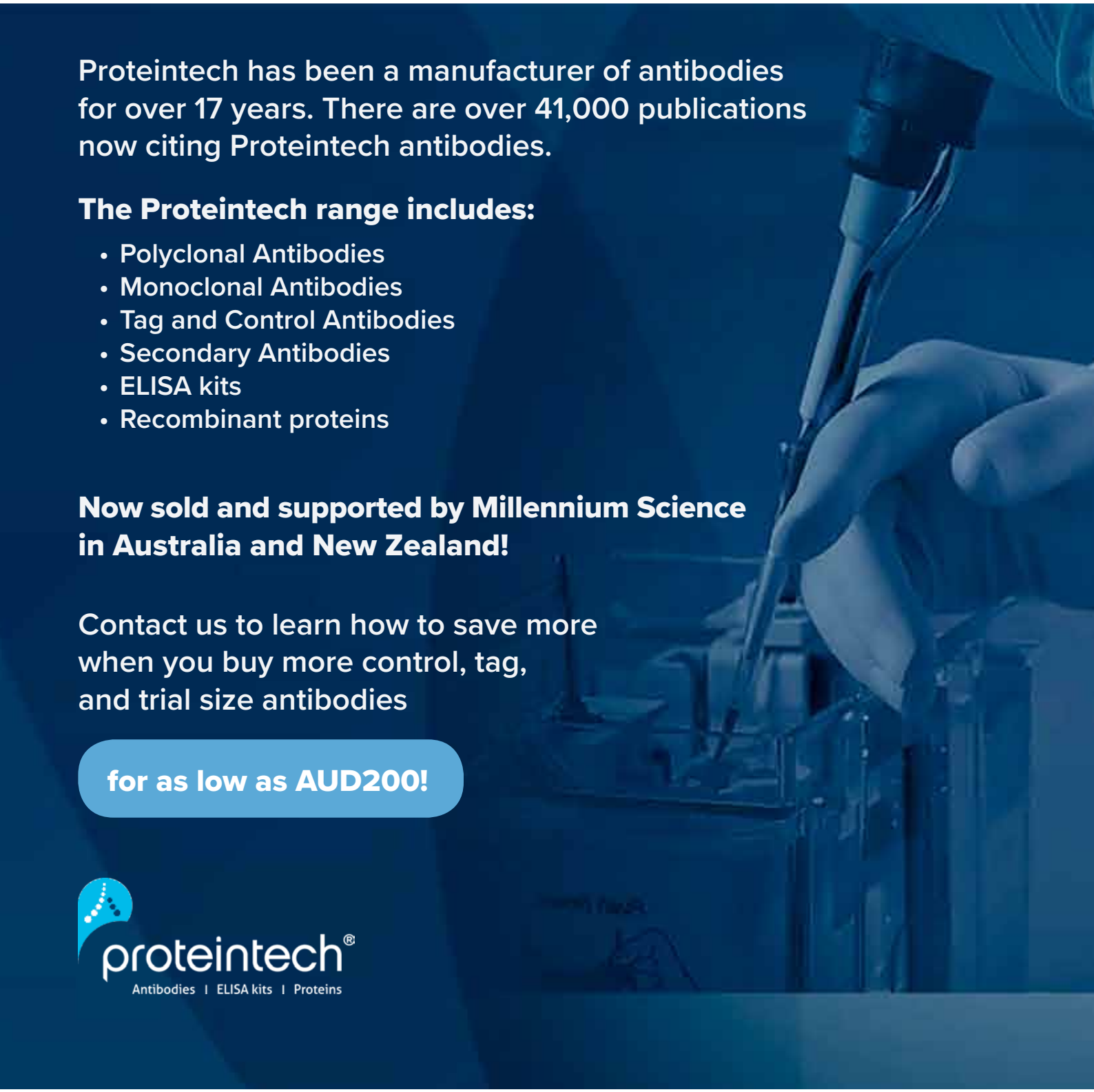

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