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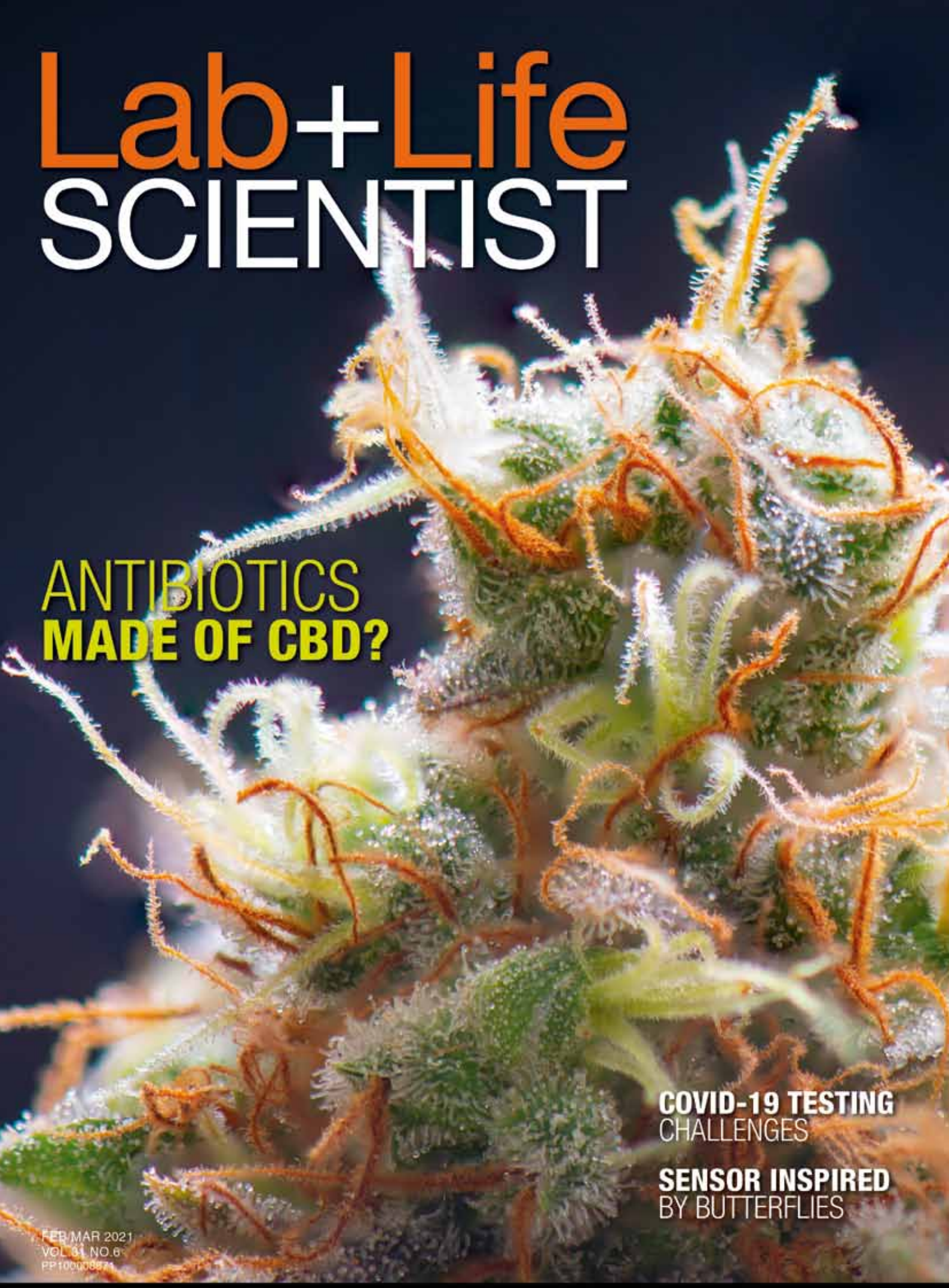

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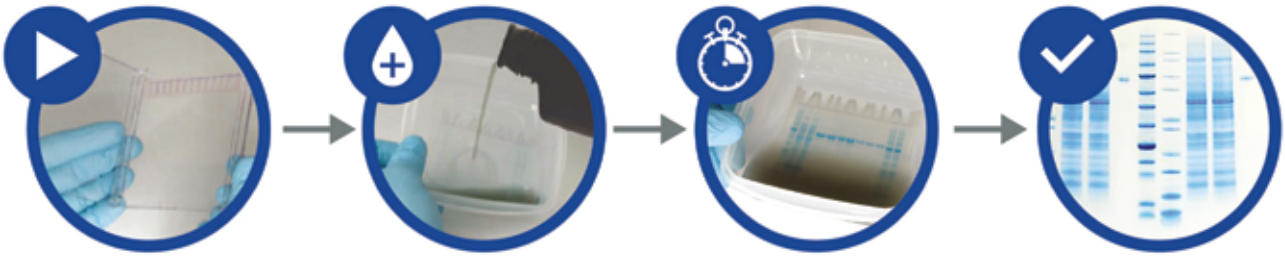

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READ ONLINE! *This issue is available to read and download at* www.labonline.com.au/magazine

Feeling under the weather?

By the time this issue reaches readers, it is likely that Australia's COVID-19 vaccination campaign will be underway. This is despite various setbacks including the abandonment of the UQ–CSL vaccine (due to false positive HIV results in study volunteers); the deaths of several elderly patients who received Pfizer and BioNTech's vaccine; the European Union introducing tighter rules on vaccine exports that threatened their shipment to Australia; and concerns that Oxford and AstraZeneca's vaccine may not work as well as some other candidates. But with the Australian Government hopeful of population-wide vaccination by October this year, we appear to be in a good position to keep the virus at bay — so long as those pesky hotel quarantine cases remain under control, of course…

So how exactly has COVID-19 affected life in the average laboratory? Turn to page 22 to learn how large-scale testing is putting pressure on labs to deliver timely, accurate results without the risk of cross-contamination — and how the key to doing so may lie in your liquid handling instruments. Speaking of lab equipment, page 6 provides several tips on how to design a functional laboratory, outlining everything from storage to safety and sterilisation.

In the quirkier side of the news, our article on page 14 outlines how the placebo effect can be used to cure nausea — which is great news for anyone who's ever been on a long car trip — and we reveal on page 18 how synthetic cannabidiol (better known as CBD) could enable the first new class of antibiotics for resistant bacteria in 60 years. I think that calls for a celebration — anyone for hash brownies?

To end on a more serious note, it should be acknowledged that once the pandemic has passed, the world will once again be forced to face other, pressing issues — namely, climate change. Back in November, CSIRO and the Bureau of Meteorology handed down their annual State of the Climate report, which among other things found that Australia's climate has warmed on average by 1.44°C (±0.24°C) since 1910 and that the frequency of extreme events such as bushfires, droughts and marine heatwaves is growing. Then in January, an international team of scientists claimed that the survival of all species is being threatened by climate change as well as loss of biodiversity, stating in their paper that world leaders need a "cold shower" regarding the state of our environment. And it appears that at least some leaders may be listening, with Australian Prime Minister Scott Morrison having recently expressed his hope to achieve net zero carbon emissions by 2050. Perhaps the events of the past year are starting to have an impact on other areas? Scientists have certainly been in the spotlight more than usual, and have arguably garnered more authority as a result. Furthermore, governments have demonstrated that they do actually have the ability to provide billions of dollars of funding on demand during a crisis, so it could be argued that the climate crisis warrants similar levels of support. Finally, Australia has been praised for its efforts in clamping down on COVID-19 early on, protecting the health of its citizens as a result, so why shouldn't the same approach be taken to protect the health of our planet?

Watch this space.

Regards,
Lauren Davis
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What lab designers need to know about equipment planning

Labs are mini ecosystems of people, devices, equipment and facilities that need to work together seamlessly. Planning the equipment you'll need ahead of time can deliver enormous savings in lab construction and operational costs.

Designing a functional laboratory means mapping out the equipment, its placement and the workflow of the users well in advance. It can be helpful to understand the typical equipment that is standard for most labs and plan enough spaces and infrastructure to support it. Let's take a look at the kind of equipment most labs typically use and talk a bit more about what they need to keep them (and their users) working smoothly.

Cold storage

Every lab needs some sort of cold storage, and selecting the right fridge or freezer is an important aspect in modern lab management. If you're replacing old equipment or setting up a new facility, there are a few considerations that

The basic energy challenge in lab design is the high cost of conditioning the large volume of ventilation air to meet safety requirements and building codes.

can help you determine which fridge or freezer will be your lab's new best friend.

First up, you'll need to figure out the temperature range you'll need, which depends on the kind of work the lab will be doing. General-purpose laboratory refrigerator temperatures range from 0 to 10°C, while freezers can range from 0 to -30°C. Ultralow-temperature freezers (ULTs) range from -40 to -86°C, while cryogenic freezers can go as low as -125°C.

You'll also need to estimate how much capacity you'll need. It's a good idea to plan for the future, and possibly invest in a bigger cold storage capacity than you might initially need. Don't forget to take ventilation into account. Some types of fridges or freezers may need more room at the back or the top to function properly, which can be a problem if there's not enough space available. A good supplier will be able to help you decide on the right model and placement for your specific needs.

Chemical cabinets and biosafety

Fume hoods are essential when working with chemicals, and biological safety cabinets (BSCs) protect workers, the environment and processes involving cells or biological tissues. Users often have a large choice when selecting a safety cabinet and it's easy to be confused by the variety of features and design styles available. The selection criteria is based on the agents used inside the cabinet, the biosafety level, and the need to recirculate or safely vent chemical fumes. They come in a huge range of form factors and types, so it can be useful to get an expert's advice on which ones would work best for your lab.

Water supply for lab work

Did you know it takes three litres of water to make one litre of deionised (DI) water? Single-pass cooling systems can easily lead to a single lab using almost 50,000 litres of water over the course of a year. Even autoclaves can use as much as 200 litres of water per cycle, even more if it's more than 10 years old.

Large labs like university research buildings often need large water purification units to produce and store RO, DI or Type III water, which then needs to be piped to various stations throughout the building without contamination. However, in some cases, smaller units — some portable and benchtop in size — might be a better way to deliver the water at the necessary purity level directly to individual stations.

Some benchtop units can even deliver Type I ultrapure water directly from tap water. When choosing a water system for your laboratory, you need to be sure of the volumes and qualities of water the lab work will require. Other important considerations include filter costs, ease of use, available water storage and system space.

Power requirements

The basic energy challenge in lab design is the high cost of conditioning the large volume of ventilation air to meet safety requirements and building codes. One way to address this is to place large, heat-generating and moisture-producing equipment in one place, so you can use energy-friendly local cooling, such as fan coil units, to cool that space specifically, rather than relying on more power-hungry central air conditioning spread across the building.

Laboratories may also have unusually high plug loads — the energy demands of computers,

servers, centrifuges and spectroscopes can be considerable. However, since lab equipment tends to be used intermittently, the load on the power infrastructure can be spread out.

Autoclaves and sterilisers

Autoclaves are basically used for two main purposes — either to steam-sterilise media, instruments or lab equipment or to inactivate biological waste materials. Sizing an autoclave depends on your daily sterilisation load requirements. It can be tempting to oversize your autoclave, thinking that it'll be good to have extra capacity in case the workload grows. But this has a huge effect on the piping, spacing and footprint of the device. Not only that, but the supporting infrastructure (plumbing, drainage, water supply, power needs, etc) will probably grow more expensive as well. Also, a bigger autoclave will be more difficult to move, and over the lifespan of the building it might need to be moved several times for repairs, maintenance or replacement. Just as important, can you spare the extra space? Luckily, you can get some highly efficient and compact autoclaves that might be ideal for your workload. Most autoclave suppliers will be happy to carry out a site survey as part of the purchase process, and it's definitely a good idea to consult them. It can save considerable costs in delivery, installation and operational costs.

Designing a lab with ergonomics in mind can improve employee comfort, productivity and job satisfaction while lowering chances for occupational injuries.

Ergonomics

Designing a lab with ergonomics in mind can improve employee comfort, productivity and job satisfaction while lowering chances for occupational injuries. Many researchers spend more than half their day working on a computer on a lab bench. Most of these lab benches are too high, and can lead to a lot of aching wrists, backs and necks with prolonged use. Things like overhead storage may seem like a great idea at first, but if it's to store something heavy or something a lab user has to repeatedly reach for, you'll quickly be getting a lot of complaints of aching shoulders or even back injuries.

A reputable lab supplier will also offer lab design services that include ergonomics, and it's a wise choice to include it in your lab planning. By thinking about workplace health and safety as you design your lab, you can potentially save thousands, if not hundreds of thousands, of dollars in the long run.

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Protein production

Understanding the workflow from start to finish

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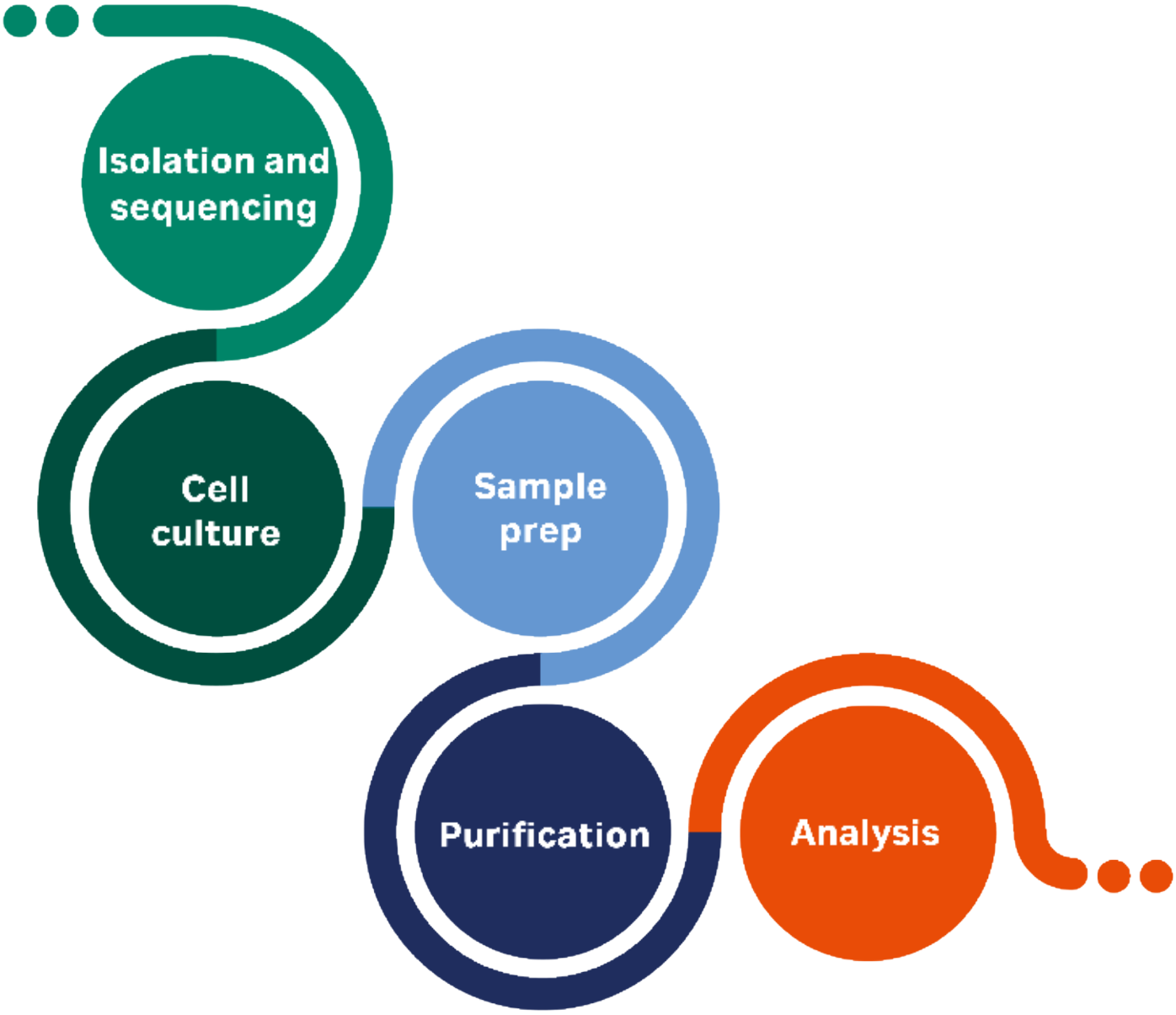

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Image credit: ICRAR

World record for laser transmission through the atmosphere

Scientists from the International Centre for Radio Astronomy Research (ICRAR) and The University of Western Australia (UWA) have set a world record for the most stable transmission of a laser signal through the atmosphere, as described in the journal *Nature Communications*.

Together with researchers from France's National Centre for Space Studies (CNES) and Systèmes de Référence Temps-Espace (SYRTE) at Paris Observatory, the team set the world record by combining the Australians' phase stabilisation technology — originally developed to synchronise incoming signals for the Square Kilometre Array telescope — with advanced, self-guiding optical terminals. Together, these technologies allowed laser signals to be sent from one point to another without interference from the atmosphere.

Lead author Benjamin Dix-Matthews, a PhD student at ICRAR and UWA, said the technique effectively eliminates atmospheric turbulence. "We can correct for atmospheric turbulence in 3D; that is, left-right, up-down and, critically, along the line of flight," he said.

"It's as if the moving atmosphere has been removed and doesn't exist. It allows us to send highly stable laser signals through the atmosphere while retaining the quality of the original signal."

The result is said to be the world's most precise method for comparing the flow of time between two separate locations using a laser system transmitted through the atmosphere — and the research has exciting applications, according to ICRAR–UWA senior researcher Dr Sascha Schediwy.

"If you have one of these optical terminals on the ground and another on a satellite in space, then you can start to explore fundamental physics," he said.

"Everything from testing Einstein's theory of general relativity more precisely than ever before, to discovering if fundamental physical constants change over time."

The technology's precise measurements also have practical uses in earth science and geophysics. "For instance," said Dr Schediwy, "this technology could improve satellite-based studies of how the water table changes over time, or to look for ore deposits underground."

There are further potential benefits for optical communications, an emerging field that uses light to carry information. Optical communications can securely transmit data between satellites and Earth with much higher data rates than current radio communications.

"Our technology could help us increase the data rate from satellites to ground by orders of magnitude," Dr Schediwy said.

"The next generation of big data-gathering satellites would be able to get critical information to the ground faster."

N95 masks can now be recharged and reused

By exposing N95 masks to 100 kV for 3 min after sterilisation in hot water or an autoclave, a researcher at The University of Tokyo has demonstrated how the masks can regain their static charge so that they can be reused. Published in the journal *Soft Matter*, the novel method can be rapidly applied to help meet the huge demand for protective equipment that can prevent the spread of SARS-CoV-2, the virus that causes COVID-19.

N95 masks have been indispensable for keeping healthcare workers and first responders safe during the current pandemic. The name comes from the fact that these masks can filter more than 95% of airborne particles, even though they have pore sizes 10 times larger than the small aerosol particles that can carry the virus. The trick is that the N95 masks are made of electrospun polypropylene fibres, which retain a static electric charge that can attract and trap the charged aerosols.

However, this static charge cannot withstand normal sterilisation procedures, such as washing in hot water or autoclaving. Even the moisture in the wearer's breath can degrade the effectiveness of the electric attraction. For this reason, the masks are often discarded after a single use, which greatly increases the gap between the number of N95 masks needed and the number available.

Now, Tokyo researcher Kaori Sugihara has shown that sterilised masks can be returned to use after being recharged using a van de Graaff generator. These devices, familiar to many science museum visitors, use the friction from a spinning belt to generate very high voltages between two metal conductors.

"Making use of the high voltage provided by the van de Graaff generator, this method is much faster than alternative methods," Sugihara said.

To regenerate a mask that had been previously sterilised, it was attached to the larger metallic sphere, while the smaller sphere was placed several centimetres away for 3 min. The regenerated masks were tested and shown to be comparable in filtering ability to unused masks.

Because van de Graaff generators are much cheaper and safer to use than other high-voltage sources, the method can be implemented easily in hospitals and other locations where N95 masks are most needed. Sugihara hopes it "will allow many more people to have access to N95 masks each day, which is our best line of defence against COVID transmission".


Image credit: Institute of Industrial Science, The University of Tokyo

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Large transporter protein may be linked to schizophrenia

Scientists have long suspected that mutations in a cellular cholesterol transport protein are associated with psychiatric disorders, but have found it difficult to prove this and to pinpoint how it happens. Now, researchers at Kyoto University have provided evidence that mice with a disrupted ABCA13 protein demonstrate a hallmark behaviour of schizophrenia.

ABCA13 belongs to a family of cellular transporter proteins called ATP-binding cassette (ABC) proteins, which are involved in moving cholesterol and other molecules into and out of cells. Kazumitsu Ueda and his team at Kyoto's Institute for Integrated Cell-Material Sciences (iCeMS) have been studying ABC proteins for 35 years, giving them extra leverage for uncovering the elusive roles of what is suspected to be the largest of these proteins, ABCA13.

The scientists studied ABCA13 in different types of human cells. They also turned off the gene that codes for the protein in mice. Finally, they investigated the effects of mutated ABCA13 proteins in human cells. The team found that ABCA13 was a large protein localised in cellular vesicles, and helps transport cholesterol from the cell's membrane into the vesicles.

"We found that ABCA13 accelerates the internalisation of cholesterol in cells and that its loss of function is associated with the pathophysiology of some psychiatric disorders," Ueda said.

Mice lacking ABCA13 looked normal and had a normal lifespan. But a series of behavioural investigations showed abnormal results for the 'startle response and prepulse inhibition test'. Normally a weak 'prepulse' stimulus, like a sound, can reduce the feeling of being startled by a subsequent stronger stimulus. However, people with some psychiatric disorders still feel startled by a main stimulus despite being preceded by a prepulse. The scientists found that both normal mice and the mice lacking ABCA13 had a normal startle response, but only the engineered mice were startled when the startling stimulus was preceded by a prepulse.

The scientists further wanted to know how ABCA1 deletion affected nerve cells in the brain. They found that vesicles in brain nerve endings in the mice that lacked ABCA1 did not accumulate cholesterol. Synaptic nerve vesicles are vital for the transmission of information from one nerve to another, so this malfunction could contribute to the pathophysiology of psychiatric disorders, the researchers say.

Finally, the scientists studied human cells containing mutated versions of ABCA13 thought to be associated with some psychiatric disorders. They found the mutations impaired ABCA13's functions and ability to locate within cellular vesicles.

The researchers suggest that further studies on ABCA13 functions could lead to the development of novel therapeutic strategies for psychiatric disorders like schizophrenia, bipolar disorder and major depression. They have published their findings in the *Journal of Biological Chemistry*.

Coral 'tumours' affect reproduction and growth

Curtin University researchers have confirmed that a tumour-like coral disease is prevalent in the reef systems around the Cocos Keeling Islands, with the growth anomalies affecting the coral's ability to reproduce and grow effectively. Their research has been published in the journal *Coral Reefs*.

Masters student Sophie Preston explained, "What makes this outbreak unique is the pristine reef in which it occurred, and that it is the first report of growth anomalies on *Isopora palifera* globally.

"Our research found that one-third of the local *Isopora palifera* population was affected by these pale tumour-like growths, with the disease present at around 75% of sites surveyed.

"These tumours are essentially rapid skeletal growths on the main colony structures. While the growths may not be affecting the coral, physiologically speaking, they are requiring the coral to expend a lot of energy to grow this deformed skeleton — energy that would normally be used for reproductive activities.

"With less energy for reproduction, there might be a decline in future generations of the coral populations. Our research suggests this coral tumour will cause at least an 11% reduction in reef reproduction in the Cocos Keeling Island coral population."

To carry out their research, the team collected samples from the Cocos Keeling Islands lagoon area, located about 2100 km from Exmouth, Western Australia. Through X-ray fluorescence analysis, they studied the chemical composition of the coral, from both infected and non-infected skeletons, as well as recording the changes in biological and reproductive components using histology.

Research co-author Dr Zoe Richards explained they found a significant difference between the healthy and non-healthy tissues, with the findings adding another layer of complexity to the search for the cause of the problem.

"What we do know is that the division of energy away from reproductive and autotrophic activities, instead towards rapid skeletal growth, is to the detriment of the biological and reproductive functioning of the coral," Dr Richards said.

"The infected tissues had a reduction in the density of polyps, mesenterial filaments and zooxanthellae, and almost a complete absence of eggs.

"Understanding the dynamics of this disease will allow us to better protect and manage the pristine coral reefs at the Cocos Keeling Islands."

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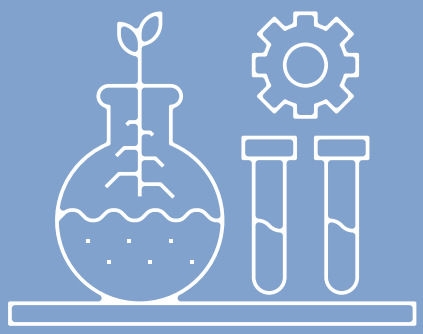

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The placebo effect, the proteome and a potential cure for nausea

German scientists have studied the phenomenon of the placebo effect in the context of nausea, and identified specific proteins that correlate with its favourable impact.

Published in the journal *PLOS ONE*, their research tells us more about the molecular bases of the placebo effect, which have until now been poorly understood.

The placebo effect is well known, but it has been investigated primarily in the context of pain syndromes — where the administration of a 'drug' to patients who are unaware of the fact that the preparation contains no active agent can have a positive impact on their condition. This has led researchers to focus on changes in brain activity, as they seem to offer the most likely substrate for the phenomenon. But the biological mechanisms responsible for the effect remain elusive.

Researchers led by Karin Meissner from LMU Munich, in collaboration with colleagues at Helmholtz Zentrum München, have now carried out the first study of the placebo effect at the molecular level, in the context of the relief of nausea. Their results not only confirm the efficacy of a placebo on symptoms, they also reveal changes in the chemistry of the blood that could explain the effect itself.

"This is the first study ever undertaken in which proteomics has been employed in the context of research on the placebo effect," Meissner said. "Proteomics is a method that allows one to identify virtually all of the proteins present in cells, tissues or body fluids. Plasma proteomics therefore provides an unbiased picture of the placebo effect at the molecular level."

Nausea occurs in many other settings — from ocean travel to pregnancy and as a side effect of

prescription drugs or anaesthetics. Yet so far, comparatively few studies have been devoted to the role or potency of the placebo effect in the treatment of nausea.

"I find nausea as a symptom particularly interesting, because it is associated with measurable changes in the activity of the stomach," Meissner said. This provides an objective physical parameter with which the mysterious placebo effect can be monitored.

The researchers first exposed a cohort of 100 volunteers to a visual stimulus known to reliably induce nausea. More specifically, they were shown a continuing succession of black and white stripes displayed on a semicircular screen 30 cm away. Their reactions to this vection stimulus, which induces the illusion of self-motion, were then assessed. The subjects were asked about their symptoms, their levels of gastric activity were measured and blood samples were obtained, which were subsequently subjected to proteomic analysis.

On the following day, the team tested how various subgroups of their experimental population reacted to a placebo in comparison to either an effective treatment or no treatment at all. In the case of the proven treatment, a transcutaneous electrical neural stimulator (TENS device) was used to deliver mild electrical impulses to particular acupuncture points on the skin. In the case of the placebo group, the treatment was either applied only superficially to the skin or the instrument was not switched on at all.

The results were astonishing, Meissner said, insofar as they appeared to confirm some of the hypotheses that have been advanced to explain the placebo effect in the scientific literature. For instance, proteomic analysis of the blood of the experimental subjects revealed the presence of specific proteins that have been linked to a rapid immune response to nausea: "And in our study, the placebo treatment seems to repress this immune response," she said.

In addition, there are indications that proteins like neurexin and reelin, which have been linked to empathetic behaviour and bonding, may be related to the placebo effect on the relief of nausea. This suggests that hormones associated with bonding may amplify the placebo effect — and it may point to an evolutionary origin of the phenomenon.

"In social mammals, grooming behaviour strengthens bonding," Meissner noted. This is a form of social hygiene — a term that could be also applied to a placebo treatment — and could stimulate the release of certain hormones that support the impact of the placebo, she added.

Finally, the proteomic signatures found in blood plasma were able to predict with surprising accuracy which of the participants would develop the most effective response to the placebo, Meissner said. One other notable observation was made during the study in relation to the effect of the placebo. Nausea is accompanied by a detectable change in the activity of the stomach muscles — this parameter returned to normal in women who received the placebo treatment, but did not respond in the corresponding male cohort.

"The reasons for this sex-related difference are not yet known," Meissner said. "But they may be connected with differences between the sexes in relation to how individuals adapt to distressing stimuli."

The researchers view their proof-of-concept study as a promising first step, as it underlines the potential of proteomic analyses in clinical research.

RNA-Seq library preparation kit

Tecan has launched the Revelo RNA-Seq kit, offering end-to-end processing of human samples to enable complete viral RNA-Seq library preparation — including library quantification — in a single day.

The kit has been developed specifically to address the pathogen detection and characterisation challenges currently faced by laboratories around the world. It is suitable for NGS library preparation from low-input, patient-derived sample types, such as nasal swabs.

The kit offers a user-friendly solution for same-day library preparation by combining an enhanced version of Tecan's SPIA (Single Primer Isothermal Amplification) technology with the company's fluorescence-based NuQuant library quantification. Optimised to provide high sensitivity for degraded or low copy number viral RNA in human samples, it allows rapid, sensitive identification and characterisation of pathogens.

The automation-friendly kit has been rigorously tested with a range of patient-derived samples containing pathogens, such as SARS-CoV-2 and other respiratory diseases. It has also been implemented on Tecan's DreamPrep NGS workstation to offer a complete, automated solution for walkaway processing, helping to increase throughput and efficiency in busy labs.

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Mass spectrometry system

Thermo Fisher Scientific has designed an inductively coupled plasma mass spectrometry (ICP-MS) instrument to enable scientists working in earth sciences, nuclear safeguards and biomedical research to conduct high-precision isotope ratio analysis across a wide range of applications, without compromising sensitivity, stability or ease of use.

The Thermo Scientific Neoma Multicollector ICP-MS (MC-ICP-MS) system combines innovative features from existing Thermo Scientific variable multicollector instrumentation. Automation and the integration of peripherals should make access to high-precision isotope ratio data easy and efficient, leading to enhanced research productivity and novel applications. The instrument offers the flexibility to quickly change between a broad range of isotopic systems, which is a key consideration for productivity in multi-user facilities.

The system combines a modern hardware design with intuitive, easy-to-learn Qtegra Intelligent Scientific Data Solution (ISDS) software and a modular concept that is designed to integrate future developments. Users will benefit from the ability to extract the finest detail of isotopic information from samples, utilising a high-sensitivity ICP interface and low noise detectors. The product also features a detector array that covers a broad range of isotopic applications.

High-quality isotopic data enables scientists to better understand the processes that shape our environment and that control the distribution of mineral resources. These data also shed light on events in Earth's history and our understanding of climate change, as well as underpinning nuclear safeguards and providing novel tools for metallomics and biomedical research. The ICP-MS system is designed to increase accessibility to the wealth of information that isotope ratio data can provide, which will benefit geoscientists as well as researchers from numerous scientific disciplines.

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Microbial colony pickers

Molecular Devices' QPix 400 Series Microbial Colony Pickers are designed to fully automate synthetic biology workflows for DNA assembly, antibody discovery and protein engineering.

Synthetic biology is a broad term that refers to the manipulation of metabolic pathways to force microbes to perform a specific biological action (often to overmanufacture molecules or proteins). Sometimes, individual genes are manipulated. Other times, entire organisms are modified for desired characteristics.

Using engineering principles to design and construct biological material, the process often requires screening and picking colonies of interest. Traditionally, colony picking is performed manually using sterile pipette tips or inoculation loops, which are usually slow, labour-intensive and time-consuming. Synthetic biology research can therefore benefit from the flexibility and throughput of an automated colony picker.

The QPix 400 Series combines intelligent image analysis with precise automation for fast and efficient screening of large libraries. Consisting of its own sterile environment with customisable HEPA filtration options and with a variety of assay tools — including organism specific picking pins, liquid handling and optional fluorescence screening — the colony pickers can automate several sample preparation and plate handling processes, such as transfer of bacterial liquid culture and plating on agar, streamlining workflow.

The series delivers a picking efficiency of >98% and picks up to 30,000 colonies per day, allowing laboratories to spend more time focusing on expanding scientific research.

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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**.

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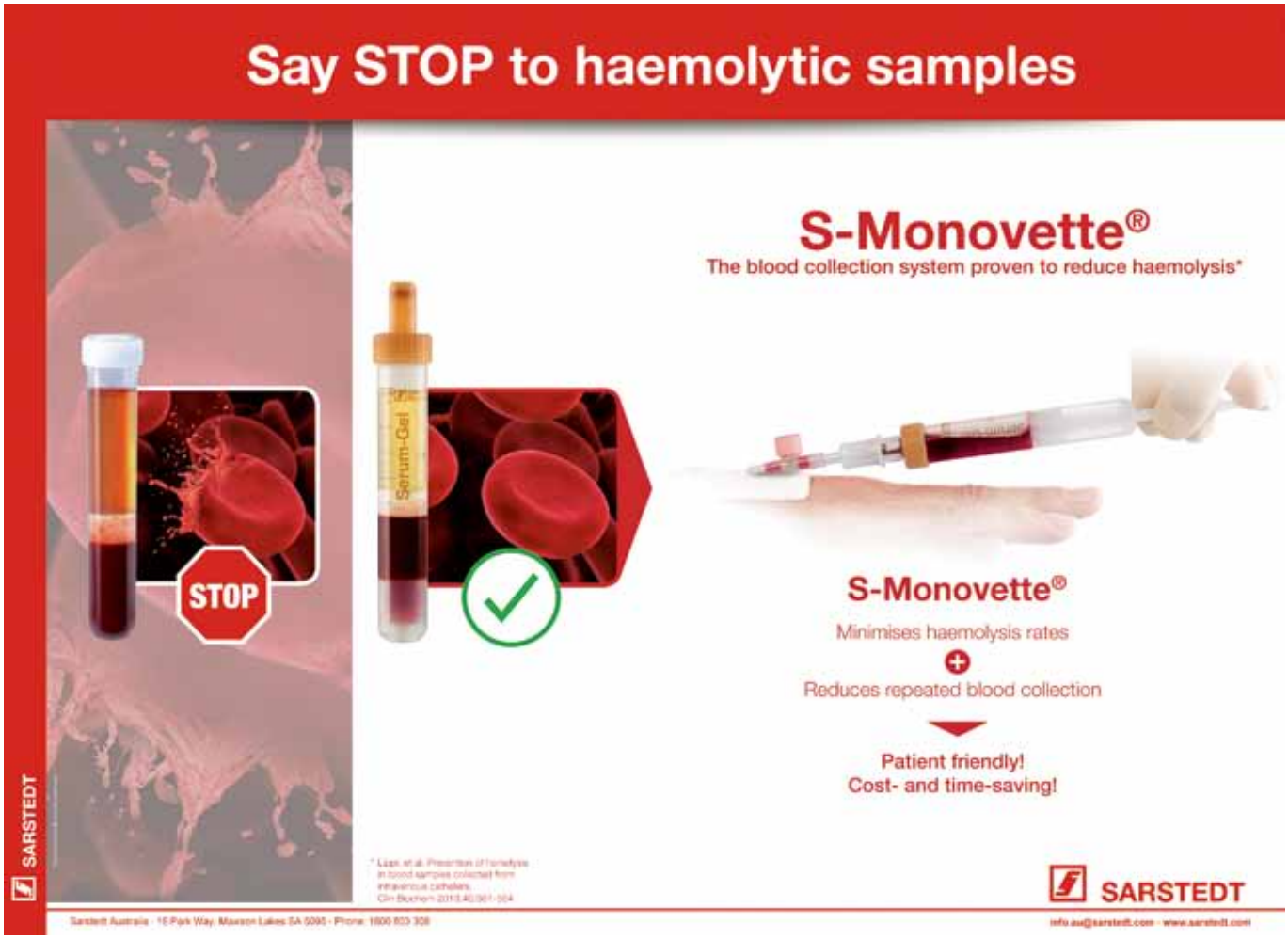

The antibiotic potential of CBD

Researchers from The University of Queensland's (UQ) Institute for Molecular Bioscience and Botanix Pharmaceuticals have shown that synthetic cannabidiol — better known as CBD — can kill the bacteria responsible for gonorrhoea, meningitis and Legionnaires' disease, in a breakthrough that could lead to the first new class of antibiotics for resistant bacteria in 60 years.

UQ Associate Professor Mark Blaskovich said CBD — the main non-psychoactive component of cannabis — can penetrate and kill a wide range of bacteria including *Neisseria gonorrhoeae*, which causes gonorrhoea. In Australia, gonorrhoea is the second most common sexually transmitted infection and there is no longer a single reliable antibiotic to treat it because the bacteria is particularly good at developing resistance.

"This is the first time CBD has been shown to kill some types of gram-negative bacteria," Dr Blaskovich said. "These bacteria have an extra outer membrane, an additional line of defence that makes it harder for antibiotics to penetrate."

The team's study, published in the journal *Communications Biology*, also showed that CBD was widely effective against a much larger number of gram-positive bacteria than previously known, including antibiotic-resistant pathogens such as MRSA (methicillin-resistant *Staphylococcus aureus*) or 'golden staph'. Dr Blaskovich said CBD was particularly good at breaking down biofilms — the slimy build-up of bacteria, such as dental plaque on the surface of teeth — which help bacteria such as MRSA survive antibiotic treatments.

Dr Blaskovich said his team at the Centre for Superbug Solutions mimicked a two-week patient treatment in laboratory models to see how fast the bacteria mutated to try to outwit CBD's killing power. He said, "Cannabidiol showed a low tendency to cause resistance in bacteria even when we sped up potential development by increasing concentrations of the antibiotic during 'treatment'.

"We think that cannabidiol kills bacteria by bursting their outer cell membranes, but we don't know yet exactly how it does that, and need to do further research."

Additionally, the team discovered that chemical analogues — created by slightly changing CBD's molecular structure — were also active against the bacteria. Dr Blaskovich said this is "particularly exciting because there have been no new molecular classes of antibiotics for gram-negative infections discovered and approved since the 1960s, and we can now consider designing new analogues of CBD within improved properties".

Vince Ippolito, President and Executive Chairman of Botanix, said the research showed vast potential for the use of synthetic CBDs as antimicrobials. "Our company is now primed to commercialise viable antimicrobial treatments which we hope will reach more patients in the near future," he said. "This is a major breakthrough that the world needs now."

Dr Blaskovich said collaborating with Botanix has sped up the research, with Botanix contributing formulation expertise that has led to the discovery that how CBD is delivered makes a huge difference in its effectiveness at killing bacteria. The collaboration has also enabled Botanix to progress a topical CBD formulation into clinical trials for decolonisation of MRSA before surgery.

"Those Phase 2a clinical results are expected early this year and we hope that this will pave the way forward for treatments for gonorrhoea, meningitis and Legionnaires' disease," Dr Blaskovich said.

"Now we have established that cannabidiol is effective against these gram-negative bacteria, we are looking at its mode of action, improving its activity and finding other similar molecules to open up the way for a new class of antibiotics."

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To know more, please visit:
www.agilent.com

Agilent

Cell lines for chromatin research

CellBank Australia has released two cell lines for the study of chromatin architecture and dynamics. The HeLa derivatives are genetically modified to carry fluorescently tagged histone H2B proteins. H2B is a core component of the nucleosome, where it plays an important role in transcriptional regulation, DNA repair and other essential cellular functions.

The first cell line, HeLa H2B-GFP, carries H2B tagged with eGFP. The second cell line, HeLa H2B-GFP, carries both a H2B tagged with eGFP and H2B tagged with mCherry. Expression of both proteins enabled study of chromatin compaction in live cells using FLIM-FRET microscopy.

The cell lines were published in ***PNAS*** in 2019, where they were used to study the remodelling of chromatin architecture at double-strand break sites during DNA repair.

CellBank Australia
www.cellbankaustralia.com

Nanoparticle size and concentration analysis

The Zetasizer Advance family of light-scattering instruments offer the versatility to deliver fast and comprehensive particle size analysis. Combining novel measurement capabilities together with an artificial intelligence (AI)-led approach to data quality assessment, the Zetasizer systems are designed to help gain more insight and further confidence to characterise size and surface charge of colloids and biomolecular nanoparticles; screen protein formulations for colloidal stability and the presence of aggregates; and assess the shelf life and stability of complex formulations.

Building on the legacy of the Zetasizer Nano series, the three core models — Zetasizer Lab, Zetasizer Pro and Zetasizer Ultra — can be tailored and quickly upgraded to suit specific application needs. The Zetasizer Advance range offers particle size (from below 1 nm to 10 μm), particle charge (zeta potential) and particle concentration analysis. In addition, each benefits from the below advances.

A data acquisition algorithm, featuring adaptive correlation, uses a statistically driven approach to produce the best correlation data, without the need for sample filtering, to deliver fast size measurements and add confidence to the results. Multi-angle dynamic light scattering (MADLS) meanwhile enables calibration-free measurement of particle concentration.

Novel constant current zeta mode allows for high ionic strength measurements previously not achievable. Improved zeta sensitivity requires much lower sample concentrations for a zeta measurement, saving precious material.

AI-guided data quality advice allows even a novice without any prior light scattering knowledge to make sense of sizing data. A novel 3 μL low-volume size cell lowers sample volume and extends concentration range.

A fluorescence filter wheel allows for extended applications with fluorescent samples, like quantum dots. Polarisation filter as well as vertical and horizontal polarisation components can be detected, potentially offering insights into particle rotational diffusion.

There are more than 100,000 publications using the Zetasizer. The product also works with OmniTrust, Malvern Panalytical's compliance solution for the regulated environment.

ATA Scientific Pty Ltd
www.atascientific.com.au

Liquid diaphragm pump

The Rocker Alligator is a compact liquid diaphragm pump that is used to transfer liquid directly to waste or a drain. ISO 8199 compliant, the product meets regulations for water quality microbiological examinations by culture.

The product is suitable for microbiological and general filtration. The compact design removes the need for excess tubing and waste bottle, making the device useful for small laboratories with limited bench space.

The pump operates at a maximum vacuum of 313 mbar and has a flow rate of 4.5 L/min. Safety features include a built-in thermal protection device and IP64 protection.

Labtek
www.labtek.com.au

Acoustic liquid handler

The Beckman Coulter Life Sciences Echo 525 acoustic liquid handler is a modern platform for tipless small-volume dispensing that is designed for use in biochemistry and genomics applications. Liquid transfer is achieved via acoustic droplet ejection (ADE), which uses focused ultrasonic energy to eject small droplets of a defined volume (25 nL for the Echo 525) from a source well into a destination well. This allows rapid, precise liquid transfer at nanolitre to microlitre scales while avoiding tip-based cross-contamination and reducing plastic waste.

The product can assemble a full 384-well plate of qPCR reactions in less than 10 min and is thus suitable for high-throughput qPCR reaction set-up. Luna qPCR reagents from NEB are compatible with Echo-mediated acoustic transfer and maintain sensitive detection and linear quantitation in 384-well format at reduced reaction volumes. In addition, using the Luna Cell Ready One Step RT-qPCR Kit, Beckman Coulter Life Sciences presents a convenient workflow for automated direct RT-qPCR analysis of cell samples, with cell culture and lysis in Echo-qualified source plates providing transfer-ready template lysates for ADE-mediated reaction assembly and high-throughput RT-qPCR analysis.

Beckman Coulter Australia
www.beckman.com.au

*David Wold**

COVID-19: 6 challenges to large-scale testing

Designing and manufacturing lab instruments that include automated liquid handling is challenging at the best of times, but in the face of increased demand for faster testing, it's even more critical to select the right partner and reliable components. The global COVID-19 pandemic is posing unprecedented challenges for laboratories as they race to meet the demand for accurate, large-scale testing in a short amount of time, and without the risk of cross-contamination.

Unprecedented pressure on liquid handling capability in the lab

Large-scale diagnostic testing is widely regarded as a key tool in epidemiology and in containing outbreaks such as COVID-19. No surprise, then, that experts including the Harvard Global Health Institute are calling for a massive scale-up in COVID-19 testing as part of measures to prevent new outbreaks. High-throughput, sequencing-based diagnostic tests are playing a central role in meeting that capacity.

The healthcare industry, including the clinical diagnostics sector, has been responding as quickly as it can with its pandemic preparedness. Harvard University recently published a document on 'Pandemic Resilience' describing the need for fast scale-up of multiple levels of testing in order to control the pandemic. The European Centre for Disease Prevention and Control has noted that once rapid commercial SARS-CoV-2 diagnostics tests are validated to have adequate performance for infection detection, additional capacity for much-larger-scale testing will be necessary to meet the operational needs for COVID-19 control in the forthcoming months.

This massive level of scaling up requires absolute confidence in testing equipment. Many labs may be unaware that the choice of pump is critical for liquid handling operations, which is why OEM providers must take this into account. That means surmounting a range of potential obstacles that can threaten process reliability — at a time when labs can least afford it.

These requirements all point to the heart of the test instrument — the pump. Automated liquid handling instruments are only as reliable as the components that they are comprised of — and when process hygiene comes into play, it's the pump that leads the way in orchestrating that all factors of process security are met. For a pump to do its job under these extreme circumstances, six process capability challenges have to be overcome.

Ensuring a pandemic-proof testing process by choosing the right pump

Achieving an accurate, reproducible and contamination-free environment for viral work comes down to how much control a lab has over its process — and whether the pump is robust enough to meet demands. Although the end user may not be aware of it, pumps and other liquid-handling components in their manual or automated processes play a critical part in success… or failure. Here are six key challenges that viral research and testing labs are facing.

1. Poor liquid-handling performance

Poor liquid handling can adversely affect the quality of sample transfer. Performance must be monitored continuously to detect the liquid level at all times, correctly dispense liquid, and avoid errors that can lead to a precious loss of time, sample, reagent, effort and money. This comes down to having a robust design in the pipetting drive mechanism.

2. Lack of precision

Imprecision can lead to inaccurate test results. It inhibits repeatability and reproducibility, which are essential to large-scale testing. Because manual sample prep is prone to human error, automated pipetting instrumentation can help eliminate this challenge.

3. Cross-contamination

Cross-contamination can affect confidence in the results for any tests. A highly sensitive detection process requires sound manufacturing and lab practices when assembling testing kits and running diagnostic testing.

> Minimising manual handling, for example with automated pipettes, reduces potential cross-contamination and inaccuracies.

4. Need for high-throughput assays and scalability

Without high-throughput COVID-19 diagnostic tests, it is difficult to achieve the additional capacity necessary for large-scale testing. Consider scale-up and avoid test instruments with inherent test limits.

5. Need for automated instruments

Minimising manual handling, for example with automated pipettes, reduces potential cross-contamination and inaccuracies. "Automated sample prep is a critical component of the overall set-up, in part because manual sample prep is prone to error and not easily scalable," notes Tim Hodge, Director of Operations at University Clinical Health, a commercial lab in Memphis, Tennessee, in a recent article on scale-up for COVID-19 testing. This is echoed by Melissa Miller, Director of the clinical molecular microbiology lab in the University of North Carolina Hospital system, who said in the same article, "We would not be able to survive without automation right now. The volume of testing has steadily increased weekly, and to have the capacity we need to serve our patients we rely on automation."

6. Meeting stringent regulatory requirements

Regulatory guidelines and approval processes can often change quickly and unexpectedly during a global health crisis, and can influence the pandemic preparedness of the health industry.

Reducing the risks of cross-contamination, which includes finding a pump that delivers precise, accurate and reproducible results, is of paramount importance in this urgent testing environment. Talk to a Tecan expert to learn more about how the choice of pump or pipette for COVID-19 testing can help labs attain pandemic-level performance —

**David Wold is the Customer Operations Manager for the Partnering Business in the Components Marketing Team at Tecan.*

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Tecan Australia
www.tecan.com

Legionella detection kit

The qualyfast DNA Extraction Kit, from Bioside, is a fast DNA extraction kit designed to detect ***Legionella*** in clear water samples. Extracted DNA can be directly used in downstream applications, including PCR and qPCR, without the need for further purification.

Commercial operations that have been closed for several weeks or even months are at a heightened risk of the waterborne pathogen ***Legionella***. Slow-moving or stagnant water allows the bacteria, which can cause the highly contagious, atypical pneumonia Legionnaire's disease, to multiply. Unused air-conditioning and cooling tower systems, many of which have been idle in recent months, pose a particular public health risk.

The qualyfast ***Legionella*** PCR range offers environmental testing laboratories a complete sample-to-answer workflow that can deliver results in hours rather than days, when compared to more conventional culture media-based methods. This enables laboratories to give businesses the all-clear for ***Legionella*** and help them to get back to work.

The kits, which are stable at room temperature, offer a simple and easy-to-use workflow including: water sample preparation to eliminate common environmental contaminant-driven false negatives; rapid and sensitive qPCR detection technology provided as pre-dosed and lyophilised reagents to enable confident identification or exclusion of ***Legionella*** species and ***Legionella pneumophila*** in samples; and quantification standards for reproducible test results.

Thermo Fisher Scientific
thermofisher.com

LED widefield illumination system

Featuring eight individually controllable LEDs and ultrafast TTL switching, CoolLED's pE-800 is a widefield illumination system that delivers high-quality data. Versatile and intuitive, the product features liquid light guide delivery, designed to make next-generation LED illumination accessible to all.

Eight individual analog inputs allow irradiance to be controlled from 0–100% for each channel via analog signal (0–10 V), which is suitable for electrophysiology and optogenetics applications. The system features <7 μs TTL triggering for live cell imaging. Capturing dynamic events is possible with high temporal resolution and even without software, due to precise hardware synchronisation via TTL input for each channel and compatibility with the pE-6501-8 (USB-controlled TTL conversion kit).

The ability to fit inline excitation filters capitalises on TTL trigger speeds, as single-band excitation filters can be installed for each channel. When used alongside multiband filters, eg, in a Pinkel configuration, this removes the need for external filter wheels and overcomes the latency restrictions of mechanical movement.

SciTech Pty Ltd
www.scitech.com.au

Flow meter/controller

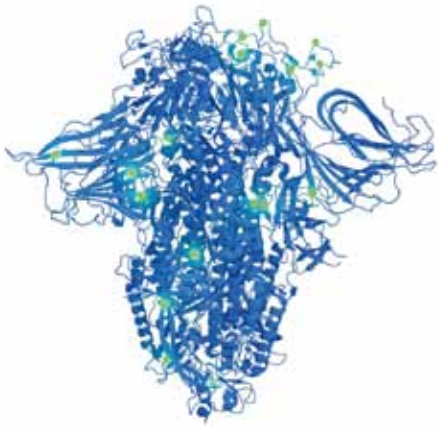
Bronkhorst presents the latest generation of ES-FLOW Ultrasonic Flow Meters for low flow rates of water, additives and other liquid substances. The improved flow meters are designed to measure volume flow from 2 up to 1500 mL/min with even higher precision, high linearity and low-pressure drop, using ultrasound in a small-bore tube.

The instruments are liquid-independent, due to a measuring principle in which the actual sound velocity is accounted for in the flow calculations. The combination of a straight sensor tube with zero dead volume means the flow meter is self-draining. The flow meter with orbital TIG-welded flanges is CIP or SIP cleanable, and now meets 3-A sanitary standards for hygienic applications. Wetted parts are made of stainless steel and the exterior design is rated to IP66 or IP67.

The local user interface is a capacitive touchscreen with a TFT display to operate and readout the instrument. For remote operation, Bronkhorst added a variety of Ethernet-based fieldbuses to the already available range of analog and digital communication options. The onboard PID controller can be used to drive a control valve or pump, enabling users to establish a complete, compact control loop.

Typical applications for the low-flow liquid flow meters and controllers can be found in food, beverage and pharma (eg, additives, sterilisation of packages), medical and chemical (eg, catalysts, reagents), and many other markets that require precision fluid handling, such as fuel consumption measurement and dosing of hydrocarbons, demineralised water, colourants or lubricants in many industries.

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



Recombinant SARS-CoV-2 spike mutants

Since emerging in 2019, SARS-CoV-2's genome has proved to be relatively stable. However, the emergence of multiple new variants in late 2020 has caused concern over the efficacy of recently developed countermeasures, including diagnostics, therapeutics and vaccines. Many mutations have occurred in the Spike protein and its receptor-binding domain (RBD), which plays a central role in pathogenesis and the induction of neutralising antibodies.

To support the investigation of SARS-CoV-2 variants, The Native Antigen Company offers a growing range of recombinant mutant spike antigens. Expressed from their proprietary mammalian expression system, these antigens display full glycosylation and proper folding for use in the development of high-performance assays and other applications.

Recombinant mutant antigens are available for the following SARS-CoV-2 lineages (spike mutations): European variant B1 (D614G); Scotland-1 (D614G, L84I, N439K); England-1 (D614G, S477N); England/Bristol-1 (D614G, V445I, H655Y, E583D); Australia-1 (D614G, G485R); Sweden-1 (D614G, E484K); and European Variant B1 (D614G).

Also available are a range of recombinant antigens for the spike mutations of the following SARS-CoV-2 lineages: UK Variant B.1.1.7; Brazilian Variant B1.1.24; B1.1.298; B1.1; B.1.258, B.1.141/B1.258; Spanish Variant B1.177; and South African Variant B.1.351 (501Y.V2).

BioNovus Life Sciences
www.bionovuslifesciences.com.au

Laboratory instrument benches with safety innovations

LabBench is constantly making improvements to its instrument benches, with a recent focus on user safety and equipment longevity.

The company's polished stainless steel structure and laminated panels make for easy COVID sanitising. Benches are totally sanitised and immediately wrapped before dispatch. They are also pallet loaded for minimal handling with clear markings on sanitising dates. All panels and parts are interchangeable and replaceable, allowing for easy modification to suit new instruments or for miscellaneous replacement.

LabBench's internal power cord containment and internal power distribution board mean that multiple instrument power cords remain internal to the bench; only the distribution board is plugged externally. Internal power distribution boards are fitted with residual current devices with overcurrent protection. These devices are 'two pole', keeping tabs on positive and neutral issues well before the instrument.

Adjustable, temperature-controlled cooling fans for vacuum pumps, with optional temperature warnings and smartphone application, take care of overheating within the integrated noise suppression chamber. Phone charging can also be incorporated into the bench.

Lab Bench
www.labbench.com.au

'Off switch' may prevent CRISPR's unwanted genetic changes

Researchers from Hiroshima University (HU) and Tokyo Medical and Dental University have developed a promising fix to CRISPR-Cas9's problem with unwanted genetic changes, using a method that allows them to turn off gene editing until it reaches key cell cycle phases where more accurate repairs are likely to happen.

CRISPR-Cas9 is a simple and inexpensive gene-editing tool, acting like scissors that can snip genetic material you want to alter. However, the process can also create so-called off-target effects — unintended genetic deletions, insertions or mutations — that limit its use in the field of therapeutics.

The researchers demonstrated more precise gene editing and suppressed off-target effects, publishing their results in the journal *Communications Biology*. Although previously developed methods have reported fewer off-target effects associated with the CRISPR technology, the researchers said these often exhibited lower editing efficiency.

"We aimed to develop the method to avoid the side effect called off-target effect, which is one of the most challenging problems in the genome-editing field," said HU Professor Wataru Nomura, a co-author on the study.

"Our method is like hitting two birds with one stone. We can improve the preciseness of genome editing and suppression of off-target effects at the same time."

The method works by using the anti-CRISPR protein AcrIIA4, which works like an 'off switch' that stops the genome-editing activity of SpyCas9. The researchers fused AcrIIA4 with the N terminal region of human Cdt1 — a gene that helps ensure DNA replication happens only once per cell division — intending to deactivate gene editing until S and G2, phases of the cell cycle when homology-directed repair (HDR) is dominant.

HDR is one of the two DNA repair processes used by organisms along with non-homologous end joining (NHEJ); of the two, HDR is the preferred method as the repair relies on the existence of two chromosome copies in each cell. HDR's use of the duplicate chromosome as a template for repair makes gene editing more precise, as opposed to NHEJ which just tends to connect the broken ends of the DNA. HDR occurs during the S and G2 phases of the cell cycle, while NHEJ operates in all phases, especially in G1 — the first phase of the cycle's interphase stage where the cell grows in preparation for DNA replication.

The researchers found that the amount of ArIIA4-Cdt1 fusion is dependent on the cell cycle. It increases during the G1 phase, which stops gene editing from happening and, consequently, halts repairs through NHEJ. Meanwhile, it decreases during the S, G2 and M phases that follow.

"The efficiency of HDR using AcrIIA4-Cdt1 was increased approximately by 4.0-fold compared to that using SpyCas9 alone," the researchers wrote. "At target or off-target site 1 (HCN1 gene), the mutation ratio was decreased by 86.5%. Moreover, the mutation ratio at off-target site 2 (MFAP1 gene) was decreased from 8.5% to 0.6% using AcrIIA4-Cdt1.

"Co-expression of SpyCas9 and AcrIIA4-Cdt1 not only increases the frequency of HDR but also suppresses off-target effects. Thus, the combination of SpyCas9 and AcrIIA4-Cdt1 is a cell cycle-dependent Cas9 activation system for accurate and efficient genome editing."

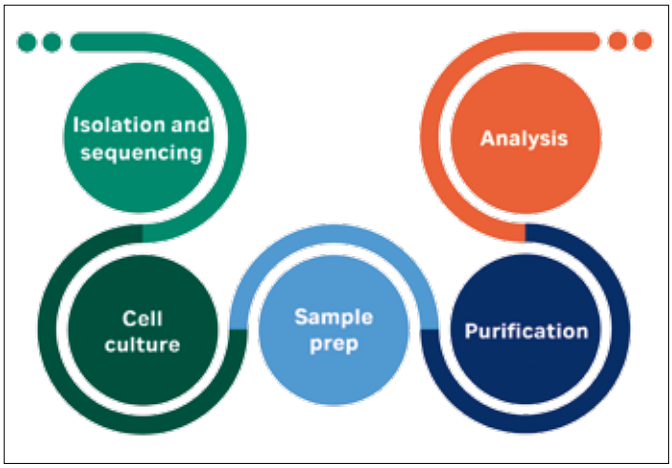
Prof Nomura said the researchers want to further improve the preciseness of the system so it could be used safely in the therapeutic field, stating, "We envision to apply our system to other CRISPR/anti-CRISPR combinations as well as other CRISPR-based gene editor such as base editors and targeted transcription mediators.

"Our ultimate goal is to develop a genome editing system which can be used safely in the medical therapeutic field."

Protein production

Understanding the workflow from start to finish

In research, the protein production, protein purification and protein analysis workflows are essential to get from idea to pure characterised protein. Achieving results quickly is important to meet pressures to publish as fast as possible.



Over the years, developments have led to simplification and improved usability for different steps in the protein research workflow, which enables individual scientists to cover all or larger parts of it.

This is good news; however, it also allows for less time for training to achieve expertise for the different steps such as gene cloning or protein purification. One person is usually not an expert in all areas, yet many of the procedures used are advanced with numerous conditions influencing the outcomes. There is therefore greater demand today for quick design of protein purification and analysis protocols and assays, ability to learn equipment fast, and easy access of instructions.

5 steps in protein research: gene cloning, cell culture, sample prep, purification and analysis

Before setting up the protocol, set goals and objectives; ask yourself these questions:

- What is the purpose of your research; will the purified protein be used to determine structure or maybe for trial therapeutic use?
- How will the identity and activity of the target be confirmed?
- What analysis methods will be used?
- Are post-translational modifications (PTM), such as glycosylation, needed for protein functionality?

Clear goals will help you to determine what expression system to use and what purity and yield to aim for, so that you get enough sample to conduct multiple analyses.

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

cDNA synthesis for qPCR

Tecan has launched the Crescendo cDNA Synthesis for qPCR system to provide increased sensitivity for low-input applications. Developed specifically to meet the needs of researchers working with scarce, precious or degraded RNA samples — such as nasal swabs — it uses Tecan's Single Primer Isothermal Amplification (SPIA) technology to generate large quantities of cDNA from as little as 500 pg of total RNA.

SPIA technology is robust, easy to use and suitable for qPCR applications, offering unbiased cDNA amplification across a broad input range. The Crescendo kit optimises this technique for limited, degraded or FFPE samples, allowing analysis of previously inaccessible samples and providing sufficient material for both qPCR and archiving.

The kit offers a practical alternative to first strand synthesis for whole transcriptome approaches, increasing the number of copies of the target gene to enable accurate detection by qPCR. It is suited to use with nasal swab and biopsy formats, allowing 500 pg to 50 ng of total RNA to be amplified to generate micrograms of cDNA for downstream applications.

The system offers a flexible solution for labs performing whole transcriptome qPCR approaches. It provides amplification of samples across a broad input range and represents a simple solution for sensitive qPCR and archiving, without consuming large amounts of precious samples.

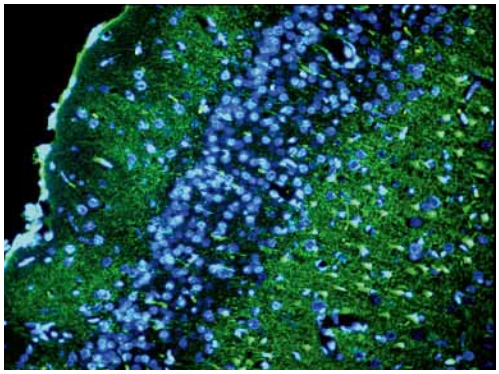
Tecan Australia
www.tecan.com

Marburg virus monoclonal antibodies

Marburg virus is one of the causes of viral haemorrhagic fever. It is an RNA virus belonging to the ***Filoviridae*** family, which also includes the Ebola virus. It is known to be found in fruit bats but can infect humans where it transmits from person to person via body fluids. Mortality rates are often >50% and there is no vaccine or therapeutic currently available. Recent outbreaks have occurred in Uganda and Angola.

ViroStat has released several monoclonal antibodies to the Marburg virus. Specificities include the VP40 matrix protein and the nucleoprotein (NP). These antibodies are reactive with the native virus and do not cross-react with the Ebola virus.

BioScientific Pty Ltd
www.biosci.com.au



Powder for detecting neuronal degeneration

The causes and effects of neuronal degeneration are of major interest to a wide variety of neuroscientists. Tools for detecting neuronal degeneration are essential for identifying mechanisms of neurodegenerative diseases and potential treatments.

Fluoro-Jade C (FJC) from Biosensis stains all degenerating neurons regardless of specific insult or mechanism of cell death. The product exhibits a good signal-to-background ratio, as well as high resolution. This translates to a stain of high contrast and affinity for degenerating neurons, making it suitable for localising not only degenerating nerve cell bodies but also distal dendrites, axons and terminals.

The dye is resistant to fading and is compatible with virtually all histological processing and staining protocols. For large-scale studies, FJC Powder is useful for processing a large number of tissue sections. Detailed protocols are provided to ensure consistency and high-quality data.

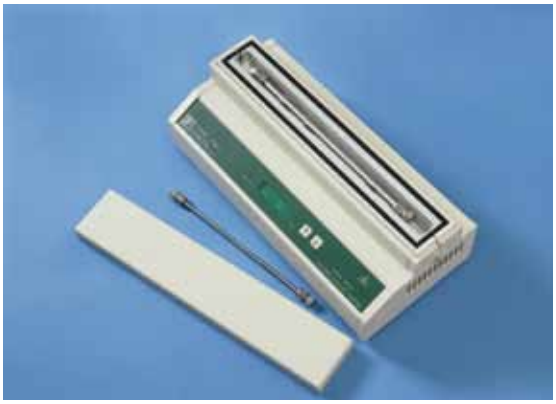
Sapphire Bioscience
www.sapphirebioscience.com

Programmable HPLC column chiller/heater

Torrey Pines Scientific announces its EchoTherm Model CO50 programmable HPLC column chiller/heater. The unit has a temperature range from 4 to 100°C readable and is settable to 0.1°C. The PID control software regulates temperatures to ±0.2°C, even at ambient. The product has a stable temperature LED that illuminates when the target temperature is stable to within ±0.2°C.

The Peltier-based device has five-program memory of 10 steps per program and the ability to repeat any program from one to 99 times automatically. It is suitable for chiral and biomedical chromatography where below-ambient temperatures help preserve bioactivity. It can be used for stabilising column temperatures from day to day at or near-room temperatures for repeatable results. It holds columns up to 30 cm long with 1/4″ or 3/8″ diameters in the mounting clips provided. Larger-diameter columns can be used by removing the column clips that hold the smaller columns.

The product features an RS232 I/O port for controlling the unit by a chromatograph, for programming gradients and for data collection. Also included are an injection counter, a 30-day timer with user-settable Auto-Off and a chamber drain for spills. It comes with a benchtop universal power supply for use anywhere in the world and a 3-wire AC line cord for the country of use. It is UL, CSA and CE compliant.



Edwards Group Pty Ltd
www.edwardsco.com.au

Wireless condition monitor

The Alfa Laval CM monitors the operating condition of rotating equipment, such as pumps, mixers and agitators, used in hygienic process environments. Compact and easy to use and install, it tracks equipment vibration, temperature and total run time to detect and diagnose equipment faults. This should enable manufacturers in the dairy, food, beverage, home-personal care and pharmaceutical industries to protect critical assets, ensure process uptime, improve worker safety, reduce maintenance costs and gain competitive advantage.

Powering the monitors are equipment sensors that transmit data to a connected compatible mobile device for predictive maintenance analysis, thereby supporting decision-making with diagnostics such as trend monitoring. Maintenance staff can check equipment vibration and temperature — either by visible notification on an LED indicator on the monitor or through an intuitive mobile app on a connected iOS or Android device within a 20 m range during a periodic walk around.

Trend analysis and FFT (fast Fourier transform) vibration data assist in diagnosing faults. These also enable operators to use the monitors to make informed decisions on scheduling maintenance and process shutdown based on actionable information in addition to actual run time and time to next service.

Alfa Laval Pty Ltd
www.alfalaval.com.au

The sensor is made with an electronic chip, which is covered with a thin layer of photonic crystals and then a titanium palladium composite.

Hydrogen sensor inspired by butterflies, powered by light

Inspired by the surface of butterfly wings, RMIT University researchers have developed a light-activated hydrogen sensor that produces ultraprecise results at room temperature.

Described in the journal *ACS Sensors*, the technology can detect hydrogen leaks well before they pose safety risks and can measure tiny amounts of the gas in people's breath. Its development follows over two decades of investigation into gas sensing by researchers in RMIT's Centre for Advanced Materials and Industrial Chemistry (CAMIC), led by Distinguished Professor Suresh Bhargava.

The core of the new sensor is made up of tiny spheres known as photonic or colloidal crystals. These hollow shapes, similar to the minuscule bumps found on the surface of butterfly wings, are highly ordered structures that are ultra-efficient at absorbing light. That efficiency means the new sensor can draw all the energy it needs to operate from a beam of light, rather than from heat — and that it is both safer and cheaper to run than commercial hydrogen sensors, which typically operate at 150 to 400°C.

"Some sensors can measure tiny amounts, others can detect larger concentrations; they all need a lot of heat to work," said Dr Ylias Sabri, who served as co-lead researcher on the study. "Our hydrogen sensor can do it all — it's sensitive, selective, works at room temperature and can detect across a full range of levels."

"The photonic crystals enable our sensor to be activated by light and they also provide the structural consistency that's critical for reliable gas sensing," added PhD researcher Ebtsam Alenezy, first author on the study.

"Having a consistent structure, consistent fabrication quality and consistent results are vital — and that's what nature has delivered for us through these bioinspired shapes.

"The well-developed fabrication process for photonic crystals also means our technology is easily scalable to industrial levels, as hundreds of sensors could be rapidly produced at once."

To make the sensor, an electronic chip is first covered with a thin layer of photonic crystals and then with a titanium palladium composite. When hydrogen interacts with the chip, the gas is converted into water. This process creates an electronic current; by measuring the magnitude of the current, the sensor can tell precisely how much hydrogen is present. And unlike many commercial sensors that struggle in the presence of nitrogen oxide, the new technology is highly selective so it can accurately isolate hydrogen from other gases.

With elevated levels of hydrogen known to be connected to gastrointestinal disorders, the technology has strong potential for use in medical diagnosis and monitoring. The current standard diagnostic approach is through breath samples, which are sent to labs for processing, but Dr Sabri said the new chip could be integrated into a handheld device to deliver instant results.

"With gut conditions, the difference between healthy levels of hydrogen and unhealthy levels is miniscule — just 10 parts per million (ppm) — but our sensor can accurately measure such tiny differences," he said.

With the ability to detect hydrogen at concentrations from 10 up to 40,000 ppm, co-lead researcher Dr Ahmad Kandjani said the sensor has a broad detection range that makes it ideal for both medical use and boosting safety in the emerging hydrogen economy.

"Hydrogen has potential to be the fuel of the future, but we know safety fears could affect public confidence in this renewable energy source," he said.

"By delivering precise and reliable sensing technology that can detect the tiniest of leaks, well before they become dangerous, we hope to contribute to advancing a hydrogen economy that can transform energy supplies around the world."

Cryopreserved Leukopaks

Lonza has expanded its human primary cell offerings with the launch of fully customisable, high-quality cryopreserved Leukopaks for biopharmaceutical researchers across the globe. The frozen Leukopaks will enable long-distance shipping of leukapheresis products without the concern of reduced cell viability encountered with fresh Leukopaks. Suitable for long-term storage in research labs, they enable immediate access to viable cells for convenience and workflow flexibility.

A Leukopak is an enriched leukapheresis-derived product containing high concentrations of peripheral blood mononuclear cells like T cells, B cells and monocytes. Such cells are a critical raw material in immunotherapy research and for optimising cell therapy process development before progressing to full clinical manufacture. However, fresh Leukopaks can be hard to access and must be used rapidly to avoid cell degradation. International transportation options are thus severely limited, and logistical delays or donor cancellations can have catastrophic impacts on research costs and quality.

Using a controlled-rate freezing process, cryopreserved Leukopaks have a longer shelf life than fresh Leukopaks, enabling stable, long-distance shipping and more convenient access to leukapheresis products. Global shipping is therefore enabled while maintaining cell viability and functionality, and the ability to thaw cryopreserved Leukopaks when needed means researchers are better able to plan ahead for therapy development — removing the risks associated with donor cancellations or changes to experimental schedules.

The cryopreserved Leukopaks are available in a range of sizes, including packs of 2.5, 5 and 9.5 billion cells, which can be subdivided into separate smaller bags for greater convenience. Specific donor characteristics like age, gender and human leukocyte antigen (HLA) type are also available, with a wide range of recallable donors and several product testing options.

Lonza Australia Pty Ltd
www.lonza.com

Safety eye shield

Bollé Safety's 'Ninka' protective eyewear is specifically designed for the healthcare and service industries, for use where there are dangers associated with splashes and droplets.

Ninka provides effective protection from splashes and droplets as well as a physical barrier while remaining lightweight and comfortable. With ergonomic 'TIPGRIP' temples that don't have pressure points, the wearer is assured of comfort and a secure fit over periods of long use.

The 23 x 7 cm lens is quickly and simply replaced and has a protective film on both sides that has to be removed before use. The lens is accompanied by an upper frame featuring an extra protection lip, which ensures enclosure at brow level for extra coverage.

A cost-effective product, Ninka comes in a range of package sizes. Lenses and frames can be purchased separately. The product is listed in ARTG, No 337956.

The product is not intended to be used against mechanical hazards. Always read and follow the instructions for use.

Bolle Safety AU Pty Ltd
www.bollesafety.com.au

Stainless steel laboratory display

The ViTAM-116 is a fully sealed, 15.6″, IP66/IP69K, stainless steel, Full HD industrial monitor. To comply with IP66/IP69K standards the device uses waterproof sealed connectors for all I/O connections. The result is a laboratory display that is not only resistant to chemicals and corrosion but can also withstand high-pressure cleaning.

The ViTAM-116 supports high-resolution 1366 x 768 pixel video with a default brightness of 350 nits. Optional sunlight-readable 1000 nits display brightness is also available. The standard I/O connections provided include VGA and HDMI video, USB 2.0 for touch screen control and 9–36 VDC power. Optional HDMI audio out can be installed allowing a waterproof speaker to be attached. Flat panel LCD touch screen options include resistive touch, projected capacitive touch or a no-touch glass front bezel.

Housed in a Grade 304 or optional Grade 316 stainless steel enclosure, the monitor is ergonomic and easy to clean. To assist with the cleaning of the display, the product includes a touch on/off button that allows the touch screen to be temporarily disabled during the cleaning process. This allows the display to be hygienically wiped down without having to shut down any applications.

The ViTAM-116 will comfortably operate in temperatures from 0 to 50°C. VESA 75 mm mounting holes allow the display to be arm or wall mounted. Optional yoke mounting is also available. For applications that require a smaller or larger display, ViTAM Series monitors are available with screen sizes ranging from 10″ to 24″.

Interworld Electronics and Computer Industries
www.ieci.com.au

Tip scanning AFM with photothermal actuation

The DriveAFM, from Nanosurf, is a tip scanning atomic force microscope designed to deliver stable, high-end performance in biological applications. It is suitable for high-resolution imaging of demanding samples such as nanostructures, proteins or polymeric structures (eg, DNA), and also for larger, micrometre-sized structures.

Full motorisation allows adjusting the lasers and photodetector, and navigating the sample, without interfering with a temperature-controlled environment. CleanDrive excitation provides clean cantilever tuning in liquid environments. The insensitivity of the CleanDrive towards environmental changes and the sensitivity of small cantilevers facilitate imaging of delicate samples over long periods of time with ease.

Seamless integration of the DriveAFM with an inverted optical microscope allows transmitted light and fluorescence microscopy to be combined with AFM imaging and force spectroscopy. The light sources' wavelengths used for CleanDrive (785 nm) and the deflection detection (840 nm) were selected to avoid interference with biological samples and to make fluorescence imaging possible.

The DriveAFM comes with a line of accessories for biological applications from single-molecule investigations to live cell observations. It includes a Petri dish holder and a 150 μm z-actuator, which is essential for cell adhesion experiments. Both sample holders are designed to maintain biological samples at physiological temperature and to be ultimately converted into a live cell incubator with temperature and CO_2 control. FluidFM, Cytomass and ANA expand the capabilities of the product with multifunctional hollow cantilevers, cell mass measurements and nanomechanical measurement automation.

Photothermal excitation of the cantilever provides good stability, a linear frequency response, and a high excitation bandwidth in air and liquid environments. These benefits allow measurements at multiple frequencies and high-speed applications, enabling more innovative measurement modes (eg, Cytomass Monitor).

SciTech Pty Ltd
www.scitech.com.au

ULT -80°C freezer

The CryoCube F101h ULT freezer offers a compact and convenient personal biological storage solution that fits under the lab bench to keep samples close at hand. With a footprint of less than 0.5 m^2, the product can store up to 6000 vessels at -80°C. This is achieved due to the system design that incorporates ultra-efficient, compact vacuum insulation panels used in combination with traditional PU foam insulation to reduce the wall thickness to 80 mm.

The under-bench, -80°C freezer operates using a green refrigerant and has a pull-down time from room temperature to -80°C in as short as 2 h 20 min. It can be equipped with a broad range of stainless steel and aluminium freezer racks for flexible storage options.

Eppendorf ULT freezers are built with energy efficiency in mind, with the goal to reduce energy consumption levels and deliver savings. By following the epGreen concept, the company's R&D team has developed intelligent solutions where energy savings are combined with durable, long-lasting product quality and ergonomic features such as a vent port located on the side of the freezer for easy re-access to samples in the freezer chamber.

Eppendorf South Pacific Pty Ltd
www.eppendorf.com.au

Filters for pharmaceutical processing

Camfil's ProSafe range of filters is designed to comply with the strict demands on safety, traceability and control within the pharmaceutical processing and life science industries.

Designed specifically for process safety and manufactured with materials that comply with European Food Contact Regulation (EC) No 1935:2004, the filter range is free of the toxic chemicals Bisphenol A, phthalates and formaldehyde and resistant to cleanroom decontamination and cleaning procedures (including hydrogen peroxide and other commonly used agents). Conforming to BRCGS global standards for food safety, the filters are also fully compliant with the ISO 846:2019 antimicrobial growth standard and the VDI 6022 hygiene in HVAC systems standard.

All filters within the ProSafe range are manufactured under strict quality control conditions and individually packaged in a hygienic bag. Models include high-efficiency pleated panel filters; multi-pocket bag filters; V-bank style mini pleat filters; HEPA panel and box style filters; and mobile air cleaners.

All HEPA classified ProSafe filters are thoroughly tested and individually certified to ensure performance under critical conditions and leak-free operation. Energy-efficient filter models, certified with an A+ EuroVent energy rating, are also available within the range.

Camfil Airepure
www.airepure.com.au

High-performance DNA kits for microbiome research

Two high-performance DNA extraction kits, suitable for a wide range of applications in soil and in faeces samples, are now available from MP Biomedicals.

The complex content of microbiome specimens can hinder scientists from getting sufficient yield and purity of DNA. With that in mind, MP Biomedicals has focused on optimising both the sample lysis and DNA isolation steps with the launch of two improved DNA kits: (1) the SPINeasy DNA Kit for Soil and (2) the MagBeads FastDNA Kit for Feces.

The SPINeasy DNA Kit for Soil employs spin column technology with proprietary buffers to protect the DNA from degradation. Improvement has also been made to remove inhibitors from difficult soil samples. Highlights include quick isolation of gDNA from soil in less than 30 min and specially formulated buffers to remove humic substances and other inhibitors.

The MagBeads FastDNA Kit for Feces allows high yield and quick isolation of genomic DNA from faecal samples. It is using magnetic beads technology with high binding capacity and selectivity for genomic DNA to isolate nucleic acids. Highlights include high yield and purity of DNA from various faecal samples. Using the magnetic bead procedure, turnover time is less than 60 min. Furthermore, the kit can be adapted to automated nucleic acid extraction instruments for high throughput processing.

MP Biomedicals Australasia P/L
www.mpbio.com/au/

Pipette calibration tracking

Research organisations may have dozens to thousands of pipettes spread across labs — and even across separate buildings or sites. Many companies struggle to compile an accurate and complete list of active assets, as pipette serial numbers become unreadable and calibration stickers wear off.

All Rainin XLS-brand pipettes have RFID tags that store information including the model, age and calibration data — the latter updated during services by METTLER TOLEDO. To leverage this rich data source, METTLER TOLEDO Rainin launched PipetteX along with SmartStand, an 'intelligent' RFID-enabled pipette stand. PipetteX monitors pipette inventories both by reading from and by writing to pipettes on SmartStands. It centrally tracks calibration dates, displays days left to upcoming service on SmartStands at the bench, stores calibration certificates, and tracks pipette age, usage, users and labs.

PipetteX sends notifications to scientists when their pipettes are nearing service dates and creates pickup lists from last-seen locations. It minimises administrative time and tasks for pipettes, reducing audit risk, and puts in place a system to monitor calibration compliance. It thus simplifies a process that once took a lot of time to manage.

Mettler-Toledo Ltd
www.mt.com

Phylogenetic study furthers our understanding of phorid flies

ioLight's Magnificent Mobile Microscope collection of high-resolution portable microscopes has helped researchers further scientific understanding of the ***Megaselia*** Rondani genus, which belongs to the phorid fly family.

Using a 1 mm pocket microscope from ioLight, the Swedish research team captured 1 μm resolution images of the specimens' setae to illustrate the morphological differences between three of the groups of ***Megaselia*** identified: the ***spinigera*** group, the ***ruficornis*** group and the 'core' ***Megaselia*** (represented by generic type species ***Megaselia costalis***. Published in the journal ***Systematic Entomology***, theirs is said to be the largest study to date of ***Megaselia*** relationships based on molecular data from one nuclear and three mitochondrial markers.

Lead analyst Emily Hartop required a portable and compact microscope to support her preliminary phylogenetic analysis of ***Megaselia*** and ongoing research. Using an ioLight microscope, she was able to analyse specimens everywhere from her living room to a laboratory on the other side of the world, capture important morphological features and Z-stack the images to achieve a detailed 3D depiction of the phorid flies.

With nearly 1700 described species and significantly more undiscovered, the ***Megaselia*** genus is notoriously challenging to study due to its extreme species diversity, limited knowledge of higher-level relationships and lack of molecular data. The new study provides a framework for future work that Hartop hopes will determine how big the ***Megaselia*** genus is, in terms of the number of species, their life history and habitats; the spatial and temporal distributions of the species; and the different evolutionary clades that may be identified in the genus.

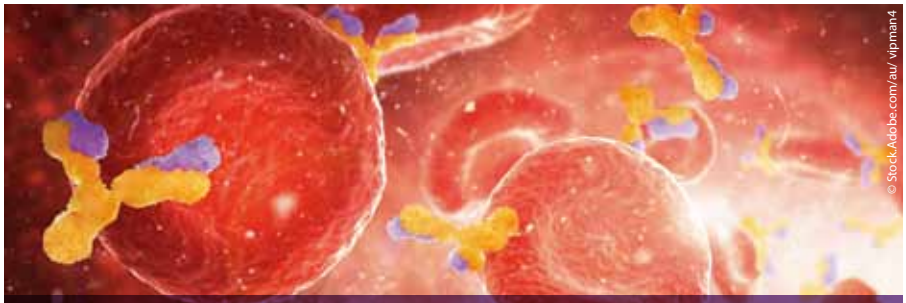
The study's primary finding revealed that the majority of the diversity found — 20 of the 22 species groups — was in the 'core' of the ***Megaselia*** genus, while two groups were outside: ***ruficornis*** and ***spinigera***. If future studies indicate the same relationships, including the illustrated setal patterns, the research team believes a definition of ***Megaselia*** can be confirmed, resulting in a significant step forward for scientific understanding and categorisation of the genus.

"We are delighted that ioLight's images play an important part in furthering the understanding of such a large and diverse genus as the ***Megaselia*** phorid fly," said ioLight co-founder Andrew Monk. "Supporting and helping to enable scientific study has always been our mission and to appear in our first peer-reviewed paper is a wonderful step towards increasing the accessibility of science."

"Democratising science is hugely important," Hartop added. "If people around the world are unable to do the same science that we're able to do in countries that are more fortunate, then that is limiting science significantly. ioLight can be a big part of helping to change this.

"I didn't set out to be the first scientist to publish a peer-reviewed journal article with ioLight's images, but that's exciting because it shows that a portable, compact microscope is perfectly capable of creating quality images suitable for publication in respected journals."

SciTech Pty Ltd
www.scitech.com.au



ASID Annual Scientific Meeting 2021

March 24–26, online

With a theme of Hospital Infectious Diseases, the ASID Annual Scientific Meeting provides an opportunity for connecting clinicians, microbiologists and other health professions with a common interest in infectious diseases and provides a friendly forum for the exchange of scientific advances in the prevention, diagnosis and management of clinical infectious diseases. International speakers will offer expert global perspectives on the conference themes and Australasian research and expertise will be highlighted with keynote lectures, proffered papers and symposia.

https://www.asid.net.au/meetings/asid-annual-scientific-meeting-2021

Science Meets Parliament 2021
March 2–April 1, online
https://scienceandtechnologyaustralia.org.au/what-we-do/science-meets-parliament/

Future Labs 2021
March 10–12, online
http://www.marcusevans-conferences-australian.com/events.asp

World Science Festival Brisbane
March 24–28, Brisbane
https://www.worldsciencefestival.com.au/

TSANZSRS 2021
May 1–2, Auckland and online
https://www.tsanzsrs2021.com/

Science on the Swan 2021
May 16–18, Perth
https://scienceontheswan.com.au/

AusMedTech 2021
May 17–21, online
https://www.ausmedtech.com.au/

AMSA 2021 Conference
June 27–July 2, Sydney
https://amsa2021.amsa.asn.au/

Pathology Update 2021
July 2–4, Sydney and online
https://www.rcpa.edu.au/Events/Pathology-Update

2021 ISFPX and ASP Annual Conference
July 5–8, Cairns
https://www.isfpx.org/

FOODCONF 2021
July 12–14, Melbourne
https://www.foodconferencesaustralia.com/

foodpro 2021
July 25–28, Sydney
https://foodproexh.com/

Collaborate Innovate 2021
August 9–11, Canberra
https://collaborateinnovate.com.au

HGSA 44th Annual Scientific Meeting
August 14–17, Adelaide
https://aacb.eventsair.com/hgsa-44th-annual-scientific-meeting/

National Science Week 2021
August 14–22, Australia wide
https://www.scienceweek.net.au/

ACS 43rd Annual Scientific Meeting 2021
August 24–28, Queenstown
https://acs2020.org.au/

ASCIA 2021 Conference
September 1–3, Melbourne
https://www.ascia2021.com/

Energy Oceania 2021
September 6–8, Melbourne
https://www.energyconferenceaustralia.com/

Australasian Exploration Geoscience Conference
September 15–20, Brisbane
https://2021.aegc.com.au/

AACB 58th Annual Scientific Conference
September 28–30, Brisbane
https://aacb.eventsair.com/aacb-58th-annual-scientific-conference/

Materials Oceania 2021
October 11–14, Brisbane
https://www.materialsconferenceaustralia.com/

AusBiotech 2021
October 27–29, Brisbane
https://www.ausbiotech.org/

16th Congress of the FAOBMB
November 22–25, Christchurch
https://www.faobmb2021.org/

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