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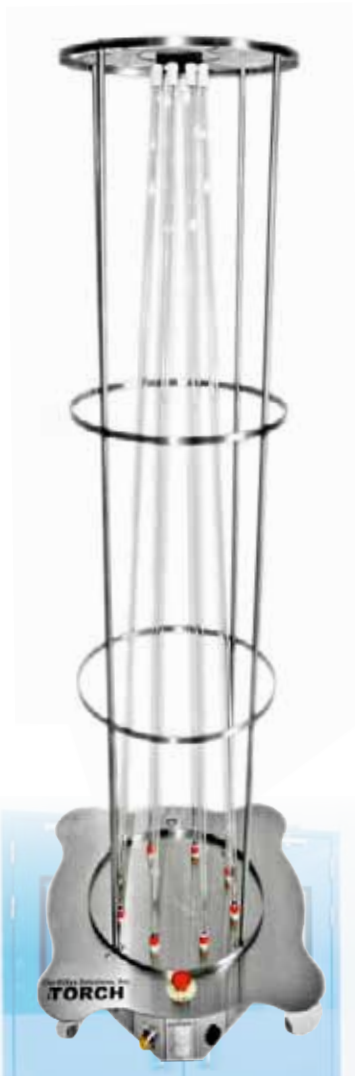

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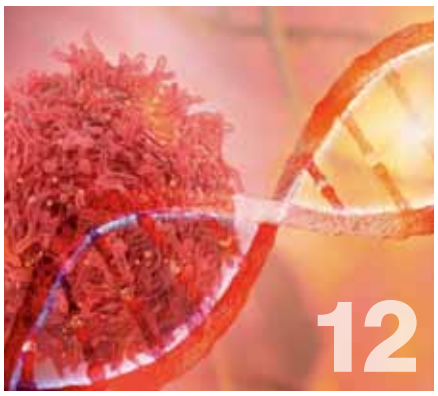

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The C word

Hindsight is a funny thing, isn't it?

Two months ago, when I was putting together last issue's editor's comment, I included a brief mention towards the end of what was then known as the 'Wuhan coronavirus' (now SARS-Cov-2, cause of the disease COVID-19), which had at the time infected close to 17,000 — a substantial number certainly, but by the time you read this, total worldwide infections are likely to be closer to 2 million. The effect not only on the healthcare system, but on every aspect of our daily lives, has been unfathomable. I'm writing right now from my dining room table, and in March I had the dubious honour of getting married in one of the last large(ish) scale weddings permitted in the country — and that was with reduced guest numbers, extra spacing between tables at the reception and a whole lot of hand sanitiser onsite.

As was the case last issue, and given the pace of research in this area, once again I am hesitant to feature too much 'current' news on COVID-19. However, here are a few Australia-specific highlights published on the LLS website in the past few weeks:

Melbourne researchers have mapped immune responses from one of Australia's first COVID-19 patients, showing the body's ability to fight the virus and recover from the infection. In an otherwise healthy person a robust immune response across different cell types was associated with clinical recovery, similar to that seen in influenza.

The Australian Government has announced $8 million for research into antiviral therapies, $5 million for clinical trials to better treat and manage COVID-19 patients with severe acute respiratory distress and $2.6 million for the Doherty Institute to fund four projects on testing, pathology and development of a framework and protocols.

New federal and state government funding will provide critical support to The University of Queensland (UQ) and its partners in their efforts to develop a vaccine against SARS-Cov-2; specifically in their analysis of vaccine efficacy and their drive to commence clinical trials as early as July.

It's also been encouraging to hear how different lab and life science companies have developed or adapted their own technologies to assist in the diagnosis of COVID-19, with one such story from data technology provider InterSystems included as a case study this issue (page 20).

But it's important that coverage of COVID-19 does not consume every waking moment of our lives, and that scientists working in other areas are able to continue their equally valid work. And so this issue we take a look at a variety of stories from across the world of science, including a novel strategy to protect honey bees from colony collapse (page 18), rapid detection of *Salmonella* in food products (page 16) and the second claimed incidence of a patient cured of HIV (page 14), just to name a few.

On a final note, I would like to say thank you to all those scientists, researchers and clinicians who, unlike myself, do not have the luxury of working at home during this difficult time — particularly those working to manage and overcome COVID-19, but also those seeking to ensure research in other fields continues ticking over. I wish you all the best with your work, your health and your wellbeing, and trust that by the next time we're in touch, the dream of returning to normality will be within reach.

Regards,
Lauren Davis
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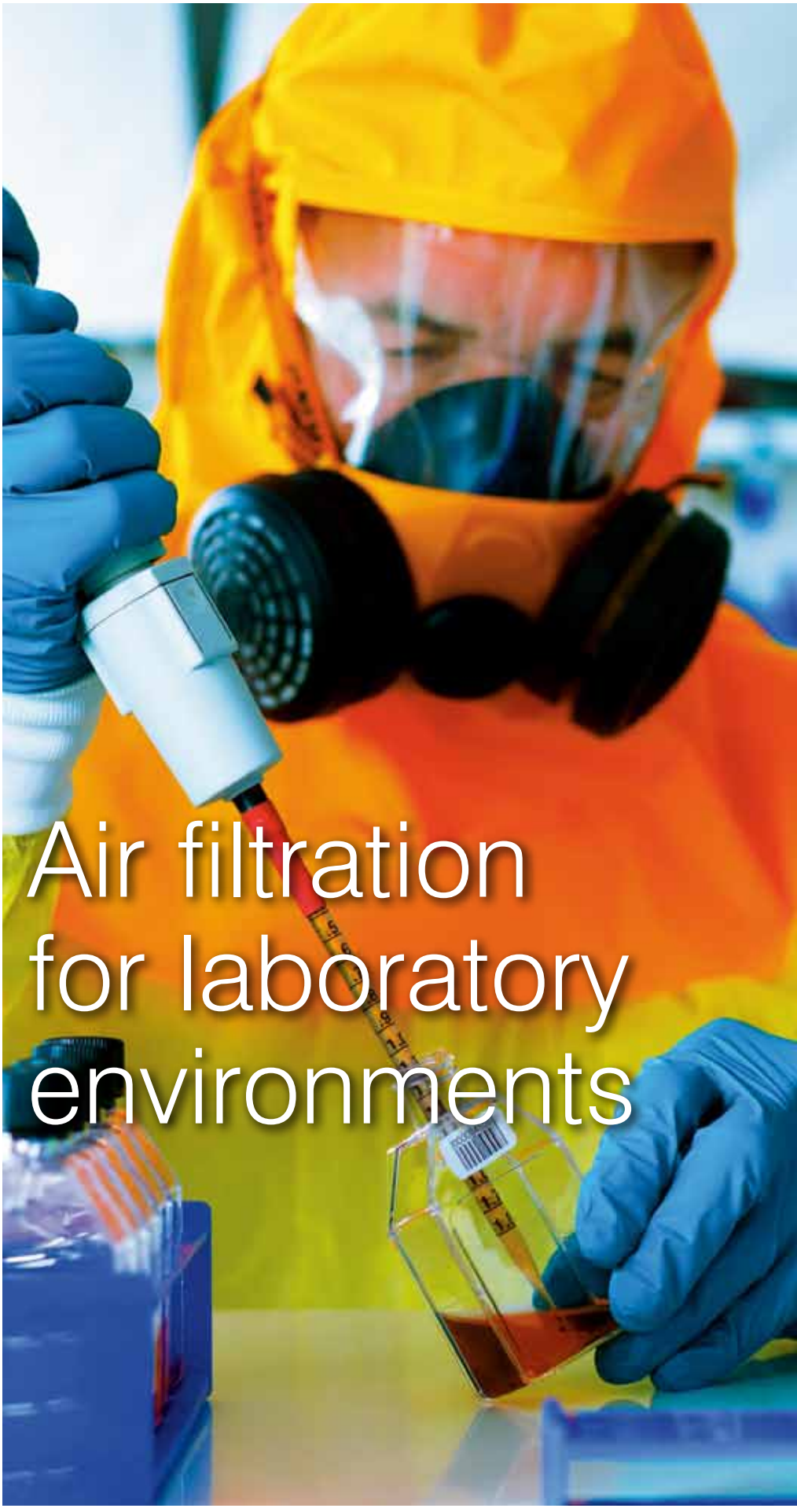
Air filtration for laboratory environments

There are many aspects to consider when maintaining effective air quality and freedom from contamination in pharmaceutical, biotech and hospital laboratory environments. Obvious considerations include compliance (or better) with various state and federal standards for air changes, room pressurisation and filtration levels.



Most air filtration systems focus on providing particulate free air; however, it is worth considering that there are molecular, non-particulate contaminants that will not be controlled via conventional filtration technology.

If we look broadly at air quality within a facility, internal air quality is equally as important as the quality of air being exhausted from the building. Both are considerable aspects in worker safety and the wellbeing of workers in and around the facility.

Most readers will be very familiar with HEPA filtration units of various configurations within the facility. Generally large units are wall or roof mounted to give the appropriate 'face area' that is appropriate to the required air flow for the room.

Unit size is typically driven by two considerations: the required air flow and filter testing access. A comparatively large surface area is required to achieve an appropriately modest air flow rate through the filter (for effective filtration and reasonable static pressure drops). An incorporated filter access panel is convenient for NATA certification or HEPA integrity testing to assure air quality on a yearly basis.

Less visible to the users of the facility are the array of critical items that support these HEPA filtration units. These items include clean ductwork, effective and reliable fan and thermal control units, insect prevention inlet grills and pre-filters to remove larger particulates. In some cases UV germicidal systems to limit pathogen loads are also utilised. All of these items must work in a coordinated manner to assure cost-effective and reliable delivery of air that is particulate free to acceptable levels.

In a variety of isolation and containment situations specified by AS/NZS 2243.3, BIBO

(Bag In/Bag Out) airborne containment systems will be required.

Molecular contaminants have significant impacts on the health and wellbeing of the staff and clients in these facilities. Generally unnoticed, unless associated with offensive odours, these contaminants form a very important aspect of the air quality within a facility.

Molecular contaminants can commonly include acidic gases, bases, condensables (that can condense on clean, cool surfaces), organometallics, and sulfur and nitrogen oxides. Ozone can be an issue in some circumstances as well.

These items can be sourced from outdoor entrainment, scientific or medical devices, fugitive emissions from process equipment, chemical storage areas or laboratories, and temporary emissions from construction or repairs.

Significant loads of undesirable chemicals can also be introduced into buildings from heavily used car parks, emergency delivery docks or helipads, which in turn affect the 'clean air' systems of these facilities. The reader will be familiar with the types of airborne chemicals of concern in this area — carbon monoxide and dioxide, sulfur and nitrogen dioxide, reduced sulfur compounds, halogen gases, ozone, and chemicals associated with fine diesel particulates. In more rural areas, materials associated with fertilisers and insect control measures may also feature on the list.

Indoor contaminants are seldom considered, but can be especially relevant in new or recently renovated buildings. The off gassing of building materials and furniture, human activities, cleaning chemicals and test and maintenance materials can introduce significant chemical load to the interior of the building.

By way of example, we can consider the impact of airborne chemical contamination on IVF clinical environments. Success rates have been linked to aspects of chemical air quality in the clinical environment.

A variety of chemicals from outside sources may impact on these IVF environments, including automotive and diesel contaminants from helicopter pads and outside areas that can be included in makeup air, as mentioned previously. A control strategy for these items includes both conventional particulate removal and chemical absorption by dry media materials housed in filters or scrubbing units.

In general terms, chemically contaminated air is passed through beds of dry media particles at a predetermined rate and residence time. Designed and implemented correctly, these filter beds are able to remove more than 99% of many common contaminants.

The process of chemisorption, absorption and reaction that are employed are complex but well understood. Materials are readily available and consistent in terms of quality and performance. The media have extremely high surfaces area, similar to activated carbon; however, base materials like activated alumina and impregnates like permanganate may be used to provide superior retention and binding capacity of contaminants.

The consumption of the dry filter media is directly driven by the contamination load — the more contamination, the more material that will be used. Generally an aim of the system design will be to give one year of life between change-out of filter media. However, real-life application can only be determined in practice. Sampling of the media is possible for exhaustion testing — so that the remaining media life can be calculated. The media essentially works at 100% of the nominal efficiency until exhaustion, then this efficiency plummets to zero.

In most cases, the media is general waste, which makes it relatively easy and inexpensive to dispose of. When used in radio-nucleotide or particularly hazardous environments, testing before disposal will need to be done.

The range of uses in clinical environments for this chemical scrubbing material is extensive. Examples include odour control for insulin production, ammonia scrubbing for research animal enclosures and removal of fugitive emissions for sterilisation units. There are literally solutions for any chemical material that can be safely absorbed and recirculated.

There are several layers of air filtration and purification that can be used together to assure high-quality air in hospital, clinical and pharmaceutical/biotech environments.

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Updated standard to reduce errors in medical laboratories

The reliability of laboratory results in medical settings is essential for correct diagnoses and positive clinical outcomes, so implementing measures to reduce the risk of errors should be considered an essential part of business. To assist with this, a leading guidance document for risk management in medical laboratories has just been updated.

ISO 22367, *Medical laboratories – Application of risk management to medical laboratories*, specifies a process for a medical laboratory to identify and manage the risk to patients and service providers that are associated with medical laboratory examinations. It has been updated to align with other International Standards in the industry, such as ISO 14971 for risk management in medical devices, and to provide more effective guidance for the sector.

The standard replaces ISO/TS 22367, *Medical laboratories – Reduction of error through risk management and continual improvement*, a technical specification used by governments and laboratories around the world to help reduce and manage risks associated with medical laboratory services.

ISO 22367 was developed by ISO technical committee ISO/TC 212, *Clinical laboratory testing and in vitro diagnostic test systems*. Committee Chair Dr Jack J Zakowski said risk management in medical settings is complex because it involves the cooperation of many stakeholders, and each stakeholder may have a different perspective on the risk of harm; internationally agreed and adopted standards therefore ensure adequate safety levels.

"Activities in a medical laboratory can expose patients, workers or other stakeholders to a variety of hazards, which can lead directly or indirectly to varying degrees of harm," he said.

"Effective risk management involves a planned, systematic process that addresses both the probability of harm occurring and the consequences of that harm.

"It works best when aligned with quality and safety management to cover all possible sources of risk, which is why ISO 22367 was updated to correspond with the latest version of ISO 14971 for risk management in medical devices and ISO 15190 that provides guidance on medical laboratory safety. It is also a key requirement of ISO 15189 for the quality and competence of medical laboratories."

ISO 22367 can be purchased from Standards Australia or through the ISO Store.

Queensland and India form bioscience alliance

Life Sciences Queensland (LSQ) has formed a partnership with India's Association of Biotechnology Led Enterprises (ABLE), enabling Queensland organisations to access innovation and collaboration opportunities in India's US$12 billion biotechnology sector.

Announced at the BioAsia 2020 conference, held in India in February, the ABLE-LSQ Collaborative Alliance will see the two industry associations promote, develop and grow the bioscience sector across the Australian and pan-India regions for the next five years. With specific focus on biotechnology, pharmaceuticals, clinical trials, start-ups and the international bioeconomy, the alliance will act as a nexus for innovation, investment opportunity and collaboration.

LSQ Chief Executive Officer Clare Blain said the alliance is an important initiative that will help shape the future of the life sciences industry in Queensland and beyond.

"This memorandum of understanding [MoU] with ABLE is not only a testament of mutual recognition of each other's strengths in life sciences — it will create increased opportunities for our organisations to use our existing networks, resources and expertise, and share agendas to form new collaborations and help diversify and strengthen the biosciences industry on an international scale," she said.

As part of the collaboration, Queensland organisations stand to benefit from synergies in the life sciences ecosystem, including regular roundtable meetings with key Indian industry stakeholders, reciprocal delegate exchange and a start-up exchange program providing budding Queensland bioscience organisations the opportunity to accelerate their growth on a global scale. The initiative will also open new doors for Indian companies to explore research and industry collaborations in Queensland.

ABLE Chairperson Dr Kiran Mazumdar-Shaw said this type of international partnership is vital for industry growth.

"This is the way forward in collaboration between innovative companies in Queensland and India, to co-create many exciting products and solutions in biotechnology that will tackle the challenging healthcare needs of our communities," she said. "While an MoU is the first step, the real task is to make it a reality quickly with meaningful collaborative projects from both sides."

Trade and Investment Queensland Commissioner Gitesh Agarwal added, "As India and Australia come closer than ever before, the time is right to find real solutions for real problems. Queensland is poised to be an ideal partner for India to collaborate and co-create with."

The ABLE-LSQ Collaborative Alliance was formally established with the signing of an MoU at the BioAsia 2020 conference, followed by an interactive session for members to address initial Indo-Australian collaboration opportunities to kick off the five-year partnership.

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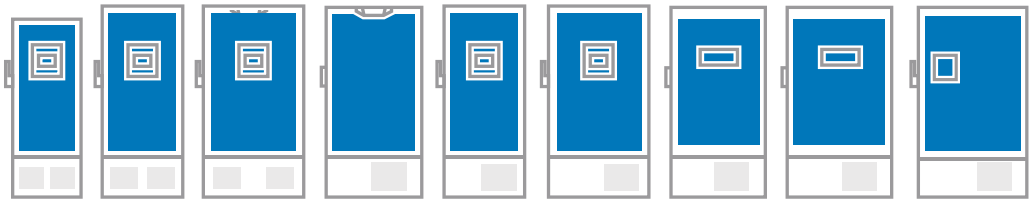

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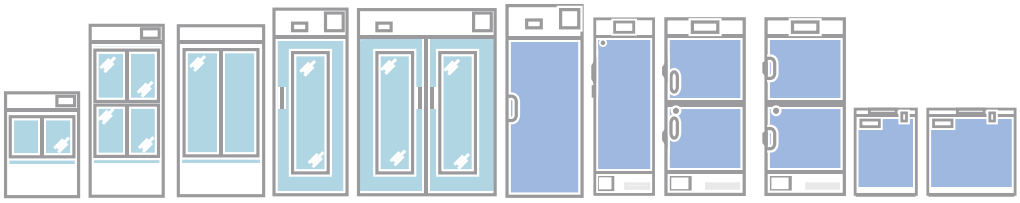

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Curcumin can be delivered to the body via nanoparticles

Curry lovers rejoice — an international team of researchers has shown how the active compound in turmeric, curcumin, can now be delivered effectively into human cells via tiny nanoparticles.

Curcumin is said to contain anti-inflammatory properties, but the failure of the body to easily absorb the compound has been a thorn in the side of medical researchers seeking scientific proof that curcumin can successfully treat cancer, heart disease, Alzheimer's and many other chronic health conditions. Now, researchers from the University of South Australia (UniSA), McMaster University and Texas A&M University have developed a nano formulation that changes curcumin's behaviour to increase its oral bioavailability by 117%.

The researchers have shown in animal experiments that nanoparticles containing curcumin not only prevent cognitive deterioration but also reverse the damage. Their findings, published in the *International Journal of Molecular Sciences* and *Drug Delivery and Translational Research* (part I and part II), pave the way for clinical development trials for Alzheimer's.

"Curcumin is a compound that suppresses oxidative stress and inflammation, both key pathological factors for Alzheimer's, and it also helps remove amyloid plaques — small fragments of protein that clump together in the brains of Alzheimer disease patients," said UniSA neuroscientist Professor Xin-Fu Zhou.

The same delivery method is now being tested to show that curcumin can also prevent the spread of genital herpes, with UniSA Professor Sanjay Garg noting, "Curcumin can stop the genital herpes virus — it helps in reducing the inflammation and makes it less susceptible to HIV and other STIs.

"To treat genital herpes (HSV-2) you need a form of curcumin that is better absorbed, which is why it needs to be encapsulated in a nano formulation."

Women are biologically more vulnerable to genital herpes as bacterial and viral infections in the female genital tract (FGT) impair the mucosal barrier. Curcumin, however, can minimise genital inflammation and control against HSV-2 infection, which would assist in the prevention of HIV infection in the FGT. The new delivery method is therefore well positioned to help prevent and treat a range of diseases.

Speeding up the development of pulse seeds

A research collaboration led by The University of Western Australia (UWA) has created a new technique that speeds up the development of seeds, producing better quality and more abundant pulse crops as a result.

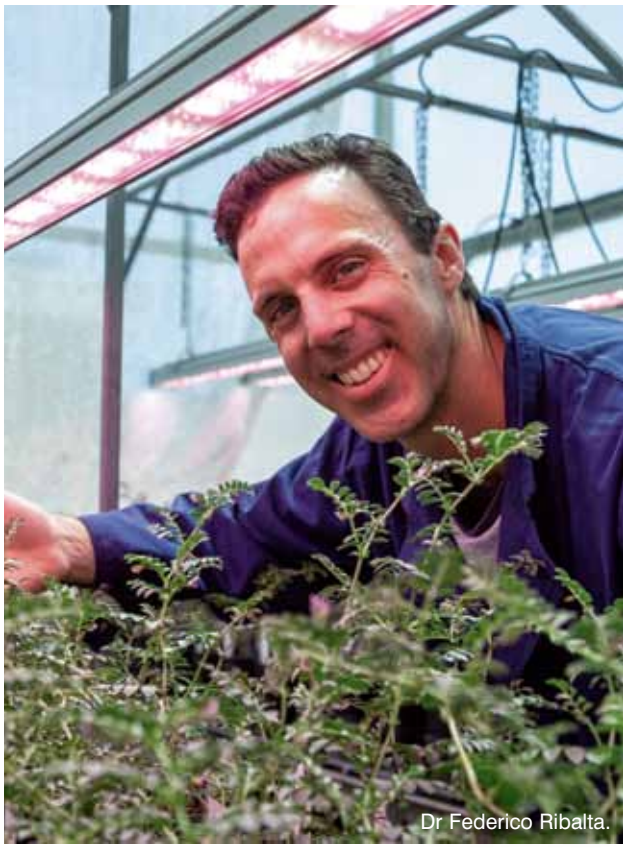
Scientists from UWA's Centre for Plant Genetics and Breeding developed the pulse-breeding platform to allow seeds to develop faster by rapidly accelerating the plant life cycle. The research was supported by the Grains Research and Development Corporation.

Australia produces around 2.25 million tonnes of pulses annually; however, changes in the production environment such as climate, new pests, water shortages and higher farming costs have led to pulse breeders looking for better strategies to ensure their crop material can adapt to changing conditions.

The accelerated-Single-Seed-Descent (aSSD) platform uses LED technology to encourage the plants to flower quickly and develop their seeds faster. The resultant crops are said to be more resilient, to require fewer chemical treatments and to have reduced running costs.

Lead researcher Dr Janine Croser said the research was carried out in response to feedback from farmers about practical problems on the land. "As we move into more instability in our regions, we will be able to respond more quickly to emerging issues and address these through our breeding platforms," she said.

UWA researcher Dr Federico Ribalta added that the team has extended the research to investigate the development of key breeding populations for Australian-grown legumes. He said, "Working in close collaboration with breeders means that there is a faster release of new varieties for farmers."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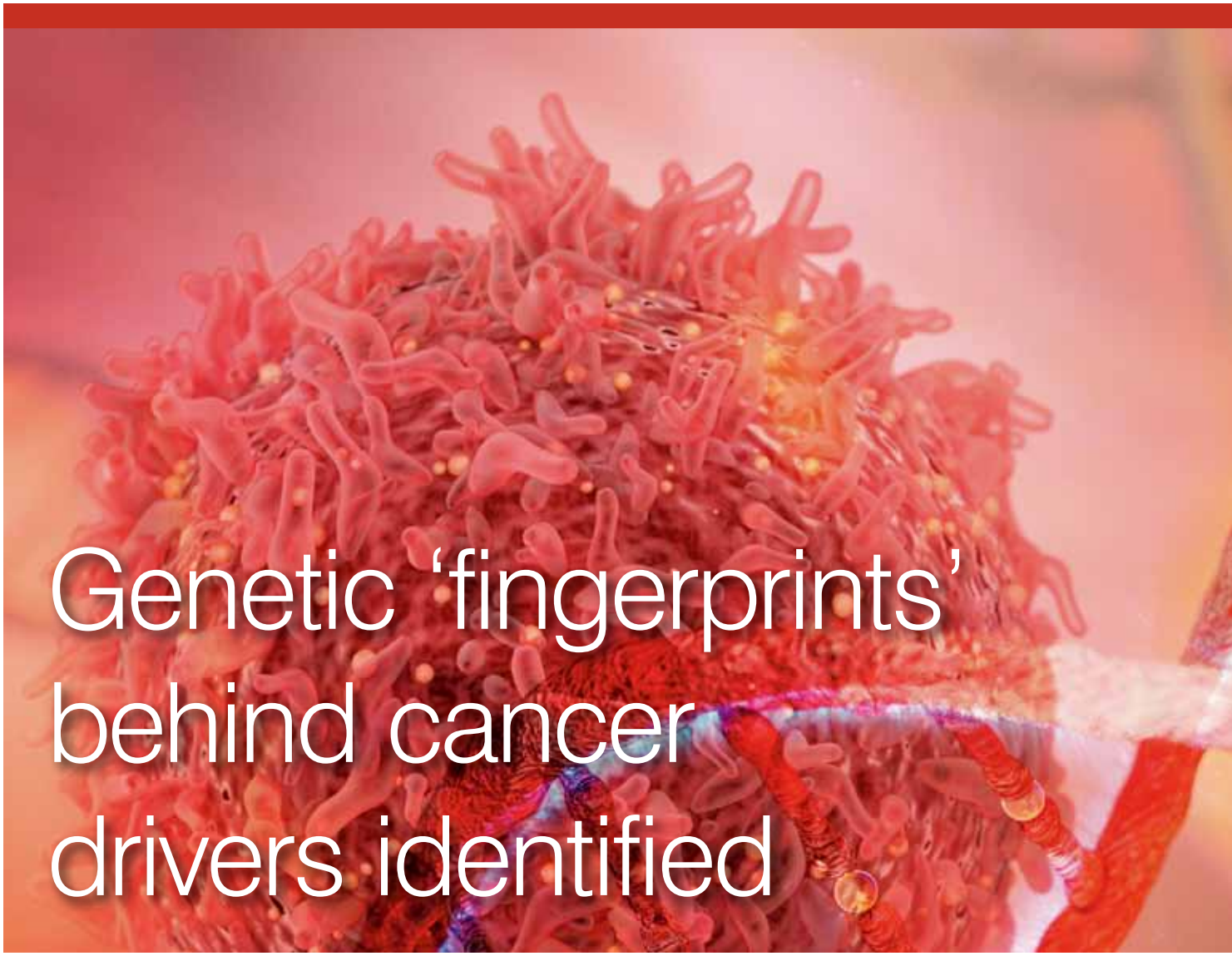


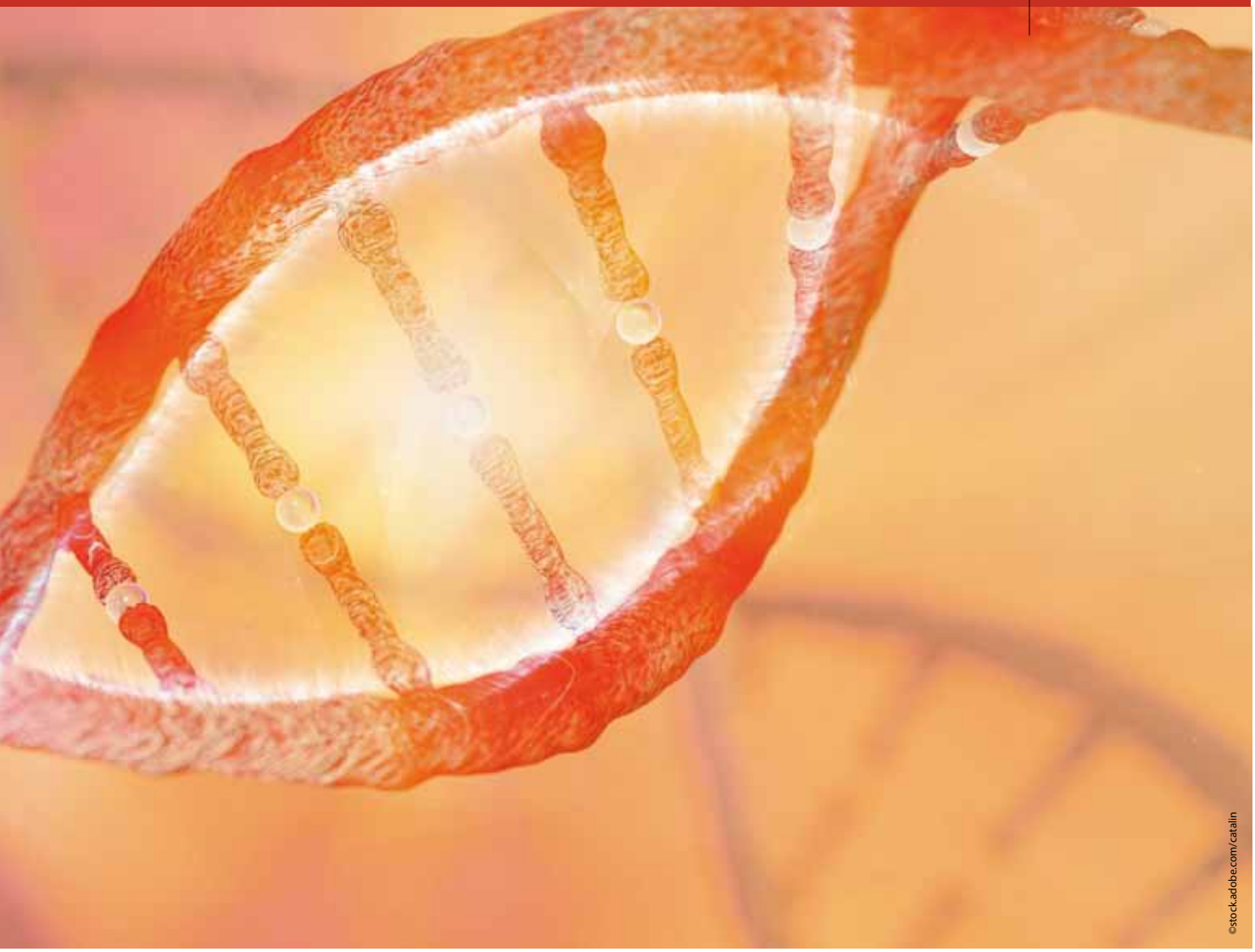
Genetic 'fingerprints' behind cancer drivers identified

An international team of over 1300 researchers has conducted what is claimed to be the most comprehensive study of whole cancer genomes to date, allowing scientists to search for previously unknown chemicals, biological pathways and environmental agents responsible for causing cancer.

Cancer is caused by genetic changes — mutations — in the DNA of a cell, allowing the cell to divide uncontrollably. Many known causes of cancer, such as UV light and tobacco smoking, leave a specific fingerprint of damage in the DNA, known as a mutational signature. These fingerprints can help understand how cancers develop, and potentially how they can be prevented. However, past studies have not been large enough to identify all potential mutational signatures.

Now, collaborators from the Pan-Cancer Analysis of Whole Genomes (PCAWG) study — also known as the Pan-Cancer Project — have analysed more than 2600 samples from 38 cancer types, ranging from common cancers like colorectal and breast cancers to rare cancer types including pancreatic and brain cancers. Published in the journal *Nature*, this analysis has enabled the researchers to create what has been described as the first complete atlas of genomes to compare the cancers and find the common mutations between them, providing clues as to how each cancer developed. They even managed to identify new mutational signatures that had not been seen before — from single-letter 'typo' mutations to slightly larger insertions and deletions of genetic code.

The PCAWG is the collaborative effort of groups from the International Cancer Genome Consortium (ICGC), who agreed to put thousands of sets of patient genome data together and reanalyse these samples using cloud computing. Professor Sean Grimmond led the Australian effort contingent, which comprised the University of Melbourne, the Peter MacCallum Cancer Centre, QIMR Berghofer, the Garvin Institute, the University of Queensland and the Melanoma Institute of Australia, and contributed approximately 10% of primary samples from a



broad range of tumours including pancreatic, melanoma, neuroendocrine and ovarian cancer.

The researchers found on average any given tumour has four to five key mutations that are responsible for driving that disease. Previously researchers were aware of one or two drivers, so having an updated number and realising their complexity in each patient is an important step in working out where else to look when making a diagnosis. Only about half of all the mutational signatures have known causes, so the team's study could be used to help find more of these causes and better understand cancer development.

Professor Mike Stratton, a senior author of the study and Director of the Wellcome Sanger Institute, said: "Using our detailed catalogue of the range of mutational signatures in cancer DNA, researchers worldwide will now be able to investigate which chemicals or processes are linked to these signatures. This will increase our understanding of how cancer develops and discover new causes of cancer, helping to inform public health strategies to prevent cancer."

Dr Ludmil Alexandrov, a first author of the study from the University of California San Diego, added: "We identified almost every publicly available cancer genome at the start of this project and analysed their whole genome sequences. The data from these thousands of cancers allowed us to describe mutational signatures in much more detail than ever before, and we are confident that we now know most of the signatures that exist."

Prof Grimmond, from the University of Melbourne, said the atlas provides a solid foundation to understand which genes and which pathways may be damaged in each cancer type. "This research will help identify what types of genetic test are needed for each cancer type — filling in potential existing gaps that we did not even know were there," he said.

"It demonstrates better than ever before how similar damage can cause cancer in different tissues — implications mean that for example, a breast cancer drug could be effectively used to treat an oesophageal cancer."

The atlas also provides insight for challenging cancers where the tissue of origin is not known by identifying patterns of damage across various cancer types. Prof Grimmond explained, "If we don't understand where a cancer comes from, we can't even rely on traditional clinical approaches to treatment."

Having a harmonised dataset enables international researchers to learn from one cancer treatment and applies those findings to another using a cloud computing portal. That said, further research with much larger datasets will be required to enable precision medicine to truly become a reality.

"This work is helping to answer a longstanding medical difficulty: why two patients with what appear to be the same cancer can have very different outcomes to the same drug treatment," said Dr Peter Campbell, a member of the Pan-Cancer Project steering committee from the Wellcome Sanger Institute.

"We show that the reasons for these different behaviours are written in the DNA. The genome of each patient's cancer is unique, but there are a finite set of recurring patterns, so with large enough studies we can identify all these patterns to optimise diagnosis and treatment."

For access to all the open-tier data in the Pan-Cancer Project, visit https://dcc.icgc.org/.

Second patient cured of HIV, study claims

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A case report published in ***The Lancet HIV*** has detailed the second claimed incidence of a patient cured of HIV, with no active viral infection detected 30 months after stopping antiretroviral therapy (ART). And while most HIV patients can manage the virus with current treatment options and have the possibility of living a long and healthy life, experimental research of this kind can provide insight into how a more widely applicable cure might be developed in the future.

In 2011, a patient based in Berlin (the 'Berlin patient') was the first person to be reported cured of HIV three and a half years after total-body irradiation, two rounds of stem cell transplantation from a donor carrying an HIV-resistant gene (a mutated form of the HIV co-receptor CCR5) and chemotherapy. The transplant aims to make the virus unable to replicate in the patient's body by replacing the patient's immune cells with those of the donors, whilst the body irradiation and chemotherapy targets any residual HIV virus.

The patient in this study (the 'London patient') meanwhile underwent one round of stem cell transplantation and a reduced-intensity chemotherapy drug regimen, without whole-body irradiation. In 2019, a study in the journal *Nature* reported that the patient's HIV was in remission — this latest study provides follow-up viral load blood test results at 30 months and a modelling analysis to predict the chances of viral re-emergence.

Ultrasensitive viral load sampling from the London patient's cerebrospinal fluid, intestinal tissue and lymphoid tissue was taken at 29 months after interruption of ART and viral load sampling of their blood at 30 months. At 29 months, CD4 cell count (indicators of immune system health and stem cell transplantation success) was measured, and the extent to which the patient's immune cells have been replaced by those derived from the transplant.

Results showed no active viral infection was detected in samples of the patient's blood at 30 months, or in their cerebrospinal fluid, semen, intestinal tissue and lymphoid tissue 29 months after stopping ART. The patient had a healthy CD4 cell count, suggesting they have recovered well from the transplant, with their CD4 cells replaced by cells derived from the HIV-resistant transplanted stem cells. Furthermore, 99% of the patient's immune cells were derived from the donor's stem cells, indicating the stem cell transplant had been successful.

Although there was no active viral infection in the patient's body, remnants of integrated HIV-1 DNA remained in tissue samples, which were also found in the first patient to be cured of HIV. The study authors suggest that these can be regarded as so-called 'fossils', as they are unlikely to be capable of reproducing the virus. However, they added that the London patient will need continued, albeit infrequent, monitoring for re-emergence of the virus.

"We propose that these results represent the second ever case of a patient to be cured of HIV," said lead author Professor Ravindra Kumar Gupta, from the University of Cambridge. "Our findings show that the success of stem cell transplantation as a cure for HIV, first reported nine years ago in the Berlin patient, can be replicated.

"It is important to note that this curative treatment is high risk, and only used as a last resort for patients with HIV who also have life-threatening haematological malignancies. Therefore, this is not a treatment that would be offered widely to patients with HIV who are on successful antiretroviral treatment."

Study co-author Dr Dimitra Peppa, from the University of Oxford, added, "Gene editing using CCR5 has received a lot of attention recently. The London and Berlin patient are examples of using the CCR5 gene in curative therapies outside of gene editing. There are still many ethical and technical barriers — eg, gene editing, efficiency and robust safety data — to overcome before any approach using CCR5 gene editing can be considered as a scalable cure strategy for HIV."

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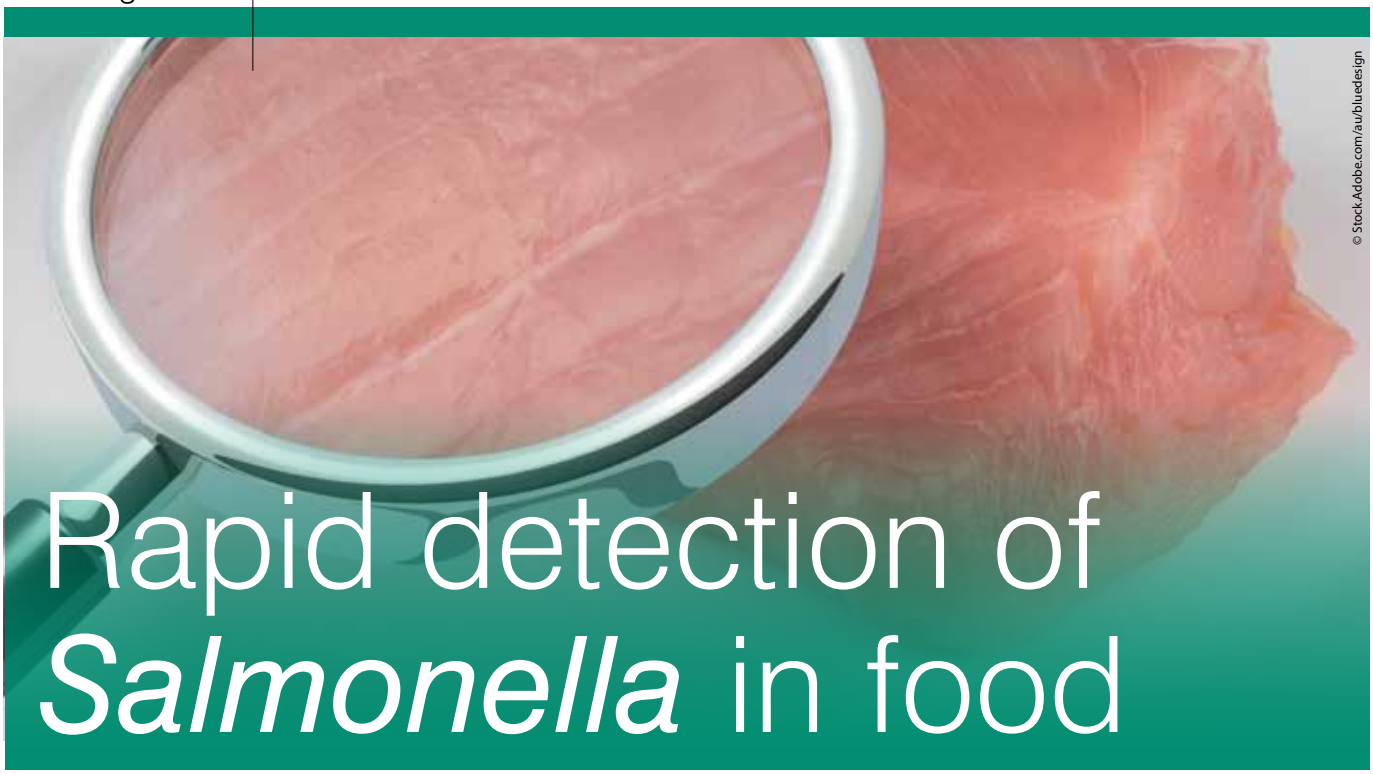
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Rapid detection of *Salmonella* in food

German researchers have developed a test that is capable of detecting ***Salmonella*** bacteria in animal products in less than eight hours, which should reduce cases of infection as well as costly recalls.

When a person consumes *Salmonella*-infected animal products such as eggs, milk, poultry, seafood or raw meat, the bacteria get into their gastrointestinal system and trigger symptoms such as diarrhoea, vomiting, fever and stomach ache. Babies, toddlers, the elderly and people with immunodeficiencies are particularly susceptible, with the latter at risk of serious complications.

When it comes to detecting the presence of *Salmonella* in animal products, traditional microbiological techniques can take up to four days. This is a major problem for food manufacturers, who cannot wait around this long for the results before shipping out their goods. Significantly faster detection methods are therefore required.

Together with the German microbiology and food analysis laboratory SELEKTIS, researchers from the Fraunhofer Institute for Cell Therapy and Immunology, Branch Bioanalytics and Bioprocesses IZI-BB are developing a rapid test that is capable of determining whether food is contaminated with *Salmonella* in less than eight hours.

Enrichment process reduced

Until now, enriching the bacteria has been very time-consuming. Enrichment involves cultivating and propagating microbes, which are available only in limited quantities, in a liquid culture medium overnight, so that there is a sufficiently high bacterial count for subsequent detection. This process lasts about 18 hours, with three further days needed for the selective enrichment and incubation of the salmonellae in additional liquid media, for the streaking of a bacterial culture on agar plates and for the serological test.

Now the project partners have managed to reduce the initial lengthy enrichment process from 18 hours to 4–6 hours. This was achieved using an innovative technique to cultivate the salmonellae.

"We did this by creating a rapid culture with growth conditions optimised for salmonellae," said Dr Harald Peter, Research Group Leader at Fraunhofer IZI-BB. "By means of an innovative, optimised enrichment method, we are able to increase the concentration of the bacteria to such an extent that we can detect them using molecular biological methods after only a few hours.

"To do this, the DNA of the salmonellae is amplified and automatically detected — something we achieve by extracting the DNA of the salmonellae and amplifying them by molecular biological means to such an extent that they can be detected after a further 30 minutes. For the rapid test, we design the molecules that specifically detect the DNA of the salmonellae."


©Fraunhofer IZI-BB.

The automated system for sample preparation and pathogen detection could look like this.

What is crucial is to obtain as high a concentration as possible of *Salmonella* DNA in a short time frame for the sensitive detection. The researchers can use fluorescent dyes to label the replicated DNA and detect it using capture molecules.

Automated system planned

Although molecular biological detection techniques are already used in laboratories, they are rarely employed in fully automated processes — and up to now not in food diagnostics. For their project, Dr Peter and his team plan to develop a system that automatically performs all procedures that are done manually, such as cultivation, enrichment, molecular biological replication and detection. In the future, all the components required will be integrated in a compact device — 40 x 40 cm in size.

Using special molecular biological techniques, the researchers can skip certain DNA purification steps, thus significantly simplifying and speeding up the process. The test can also be applied to other food pathogens — the capture molecules merely need to be adapted to other organisms using a computer and gene databases.

"The German Food Hygiene Act (Lebensmittelhygiene-Verordnung) stipulates that a sample of 25 grams of meat must not contain a single *Salmonella* bacterium," Dr Peter said. "Consequently, the new rapid test has to be capable of detecting a single bacterium within 6–8 hours — that is, within an average working day. A further task is to distinguish the salmonellae from other microorganisms."

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Bacteria engineered to protect bees from colony collapse

US scientists have developed a new strategy to protect honey bees from the deadly trend known as colony collapse: genetically engineered strains of bacteria.

Honey bees play an enormous role in global food production — without them, dozens of crops, from almonds to berries to broccoli, would either vanish or produce significantly less food. But honey bee numbers have been dwindling for the past several years, with a US survey revealing that beekeepers lost nearly 40% of their honey bee colonies last winter — the highest rate reported since the survey began 13 years ago. Two major causes of colony collapse are Varroa mites and deformed wing virus, which unfortunately often come as a pair; as the mites feed on bees, they can spread the virus, while also weakening the bees and making them more vulnerable to pathogens in the environment.

Seeking to combat this problem, scientists from The University of Texas at Austin engineered bacteria to live in the guts of honey bees and act as biological factories, pumping out medicines

Alex Wild/University of Texas at Austin.

A Varroa mite, a common pest that can weaken bees and make them more susceptible to pathogens, feeds on a honey bee.

protecting the bees against both Varroa mites and deformed wing virus. Their work was led by primary investigator Professor Nancy Moran and has been reported in the journal *Science*.

Like humans, honey bees have an ecosystem of bacteria in their guts called a microbiome and also an antiviral defence mechanism called RNA interference (RNAi) that helps the body fight off certain viruses, called RNA viruses. When an RNA virus is introduced, it produces molecules called double-stranded RNAs that a healthy cell detects, triggering an RNAi immune response.

"You usually only get signs of these molecules when an RNA virus is replicating," Prof Moran said. "It's a signal that this might be an evil thing and you should attack it."

To promote a helpful RNAi response to viruses in bees, and trigger a lethal RNAi response in the mites, the team introduced modified bacteria to hundreds of bees in a laboratory setting — one strain engineered to target the virus and another for the mites. Sprayed with a sugar water solution containing the bacteria, the bees groomed one another and ingested the solution.

The team found inoculating young worker bees with the engineered bacteria led the bees' immune systems to be primed to protect them against deformed wing virus, which is an RNA virus, and caused the mites' own immune systems to fight against and ultimately kill them. Compared with control bees, the bees treated with the strain of bacteria targeting the virus were 36.5% more likely to survive to day 10. Meanwhile, Varroa mites feeding on another set of bees treated with the mite-targeting strain of bacteria were about 70% more likely to die by day 10 than mites feeding on control bees.

"This is the first time anyone has improved the health of bees by genetically engineering their microbiome," said graduate student Sean Leonard, first author of the study.

Another benefit of the approach is that researchers can use it as a tool in studying bee genetics. The engineered bacteria can knock down specific bee genes, enabling insights into the workings of the bee genome and possibly enabling new breeding strategies to produce more robust bee colonies.

The researchers believe their method could one day scale up for agricultural use because the engineered bacteria are easy to grow, inoculating the bees is straightforward and the engineered bacteria are unlikely to spread beyond bees. This is because the type of bacteria used are highly specialised to live in the bee gut, can't survive for long outside of it and are protective for a virus that strikes only bees. That said, further research will be needed to determine the effectiveness and safety of the treatments in agricultural settings.

Custom interfaces cut turnaround time for COVID-19 testing

InterSystems, a creative data technology provider dedicated to helping customers solve critical scalability, interoperability and speed problems, has responded to requests from five Australian clinical laboratories gearing up to deal with COVID-19, including St Vincent's Pathology Service (SydPath), Austech Medical Laboratories and Goulburn Valley Health Pathology.

All five laboratories ordered PCR analyser machines — normally used to test for viruses like influenza — to increase their COVID-19 testing capacity and deal with the current crisis. Each of the labs asked InterSystems to provide customised digital interfaces for their InterSystems TrakCare laboratory information systems. The interfaces were delivered in 24–48 hours and before the new machines arrived.

The TrakCare interfaces are designed to reduce data entry and ensure that each laboratory's testing rules and protocols are followed. They also enable test results to be available immediately once completed by delivering them electronically to clinicians. By integrating the new tests within each of the laboratory's normal workflows, turnaround times can be kept to a minimum, improving the responsiveness of the healthcare system in dealing with the coronavirus.

"We were prepared in early February for higher testing volumes. This included the procurement of a rapid PCR analyser which will provide our Emergency Department with a one-hour turnaround time for patients presenting with suspected COVID-19," said Greg Granger, Chief of Operations for SydPath. "InterSystems delivered an interface for the new machine within one day — an extraordinary result — bringing the instrument online as soon as it came through the door."

"We went from doing zero to 500 tests per day, with a same-day turnaround time, in the space of a couple of days," added Nadeem Khaliq, Managing Director of Austech Medical Laboratories. "We ordered the machine, requested the interface from InterSystems and it was delivered within a couple of hours. The machine came within two days. The responsiveness of InterSystems was fantastic and was part of a great team effort."


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Mohsen Bilal, head of Austech's PCR section, is directly involved in the testing for COVID-19. According to Bilal, the interface provided by InterSystems has decreased result entry turnaround time and allows the test results to be instantly accessible to the clinicians. Austech is currently finalising a specialised PCR Laboratory to accommodate two new PCR analysers, to cater for even higher volumes and shorter turnaround times.

"This will increase our capacity to provide services that ease the pressure on public hospitals, other laboratories and nursing homes with vulnerable elderly patients," Khaliq said. "It will also allow us to dedicate more resources to non-English-speaking individuals in the community who require extra assistance, including home visits for patients who are unable to attend a doctor's surgery or medical centre."

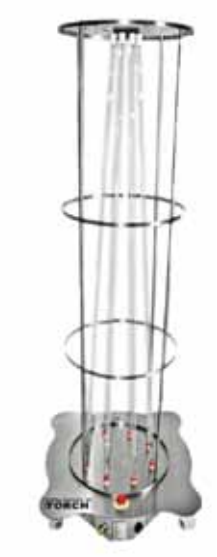
Jeremy Fowler, Information Systems Officer for Goulburn Valley Health in regional Victoria, said doing COVID-19 tests in-house, rather than referring them to labs two and a half hours away in Melbourne, will improve turnaround times.

"I opened the support ticket mid-morning and we had the interface from InterSystems in the test system by that afternoon," Fowler said. "It is certainly going to make a big difference in the lab. The scientists can do their jobs rather than entering test details and transcribing results from the instrument."

InterSystems is able to turn around the requests quickly because of its strong expertise in providing interoperability solutions to healthcare organisations globally. Digital interfaces between different healthcare information systems and devices are a core component of the InterSystems' IRIS for Health healthcare data platform on which most of the company's products are built.

Interoperability capabilities are built into both the InterSystems HealthShare unified health record and the InterSystems TrakCare healthcare information system. TrakCare's laboratory functionality is available within the unified system and as a standalone solution and is widely deployed throughout the world and regionally within Australia, New Zealand, South East Asia and China.

InterSystems Corporation (Australia)
www.intersystems.com.au



Germicidal UVC technology

With the current global coronavirus pandemic (COVID-19), the virus is active on surfaces and potentially air for 0–12 days; recent international studies have shown that the average is up to two days active on surfaces. UVC or germicidal light (254 nm) can inactivate viruses with 99% reduction of typical viruses and bacteria in a 1 min timeframe and on spores like ***C. difficile*** in 5 min. UV Solutionz High Energy Germicidal UVC Germicidal Technology is used for many applications, including killing airborne and surface pathogens such as coronavirus (COVID-19), other viruses, bacteria and moulds that live, replicate and move through the building via a building forced-air HVAC system.

Airborne pathogens are often introduced to a building via incoming occupants, fresh air intakes and on construction materials. An HVAC system cooling coil that chills the air is the ideal environment for these microbial contaminants to live and thrive in as it's a cold, damp and dark place. This results in a prime location for viruses, bacteria and mould to reproduce and then produce airborne pathogens which can affect building occupants' health and productivity. This machinery receives very little if any care in the way of maintenance/cleaning as it's generally hidden away from view and often difficult to access, and the microbial contaminants are invisible to the eye unless they prolificate to the point of being macroscopic.

UV Solutionz High Energy Germicidal UVC Technology, when installed in an HVAC system to the company's specifications, has the power to destroy airborne and surface pathogens quickly and effectively, preventing them from growing and multiplying while also sterilising the air. Germicidal UVC Technology is also designed to improve indoor air quality (IAQ) by reducing volatile organic compounds (VOCs) from such things as paints, carpets, renovations and outside introduced smells.

Forced air applications include: air-conditioned offices and commercial buildings; hospitals and healthcare facilities; laboratories and research facilities; education, schools and universities; veterinary facilities and hospitals; refrigeration-induced and force draft evaporators; foodtech and manufacturing preparation areas ventilation/recirculation systems; and agriculture manufacturing preparation areas ventilation/recirculation systems.

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Building blocks for life on Earth arrived later than we thought

Image: Julia van de Löcht

Right: Thin section of the 3.8 billion-year-old mantle rock from southwestern Greenland.

An international team of geologists has found evidence that a large proportion of the elements that are essential to the formation of oceans and life — such as water, carbon and nitrogen — only came to Earth very late in its history; much later than previously thought.

Volatile elements such as water originate from asteroids, the planetary building blocks that formed in the outer solar system. There has been a lot of discussion and controversy in the scientific community around when precisely these building blocks came to Earth, with many scientists believing that these elements were already there at the beginning of our planet's formation.

Now, thanks to a study published in the journal *Nature*, geologists have been able to narrow down this time frame more precisely. This is because Earth's oldest mantle is openly accessible in surface outcrops in southwest Greenland, allowing the scientists to easily collect rock samples.

"The rocks we analysed are the oldest preserved mantle rocks," said Dr Mario Fischer-Gödde from the University of Cologne, first author on the study. "They allow us to see into the early history of the Earth as if through a window.

"We compared the composition of the oldest, approximately 3.8 billion-year-old, mantle rocks from the Archean Eon with the composition of the asteroids from which they formed, and with the composition of the Earth's mantle today."

To understand the temporal process, the researchers determined the isotope abundances of a very rare platinum metal called ruthenium, which was already present in Earth's mantle by Archean time. Like a genetic fingerprint, this rare platinum metal is an indicator for the late growth phase of the Earth.

"Platinum group metals like ruthenium have an extremely high tendency to combine with iron," Dr Fischer-Gödde said. "Therefore, when the Earth formed all ruthenium must have been completely sequestered into the Earth's metallic core."

The pristine ruthenium preserved in the old mantle rocks most likely originates from the inner part of the solar system, the geologists report. It is presumably the same material that — for the most part — also formed Mercury and Venus. The reference values for the asteroidal ruthenium were previously obtained from meteorites found on Earth.

"If we still find traces of the rare platinum metals in the Earth's mantle, we can assume that they were only added after the formation of the core was completed," added co-author Professor Dr Carsten Münker, also from the University of Cologne. "They were certainly added during later collisions of the Earth with asteroids or smaller protoplanets, so called planetesimals."

Scientists refer to these very late building blocks of the Earth, which were delivered by these collisions, as the 'late veneer'. If ruthenium was added during this stage, it is distributed and well mixed into Earth's mantle by now. The old Archean mantle relics in Greenland, on the other hand, have preserved Earth's pristine composition.

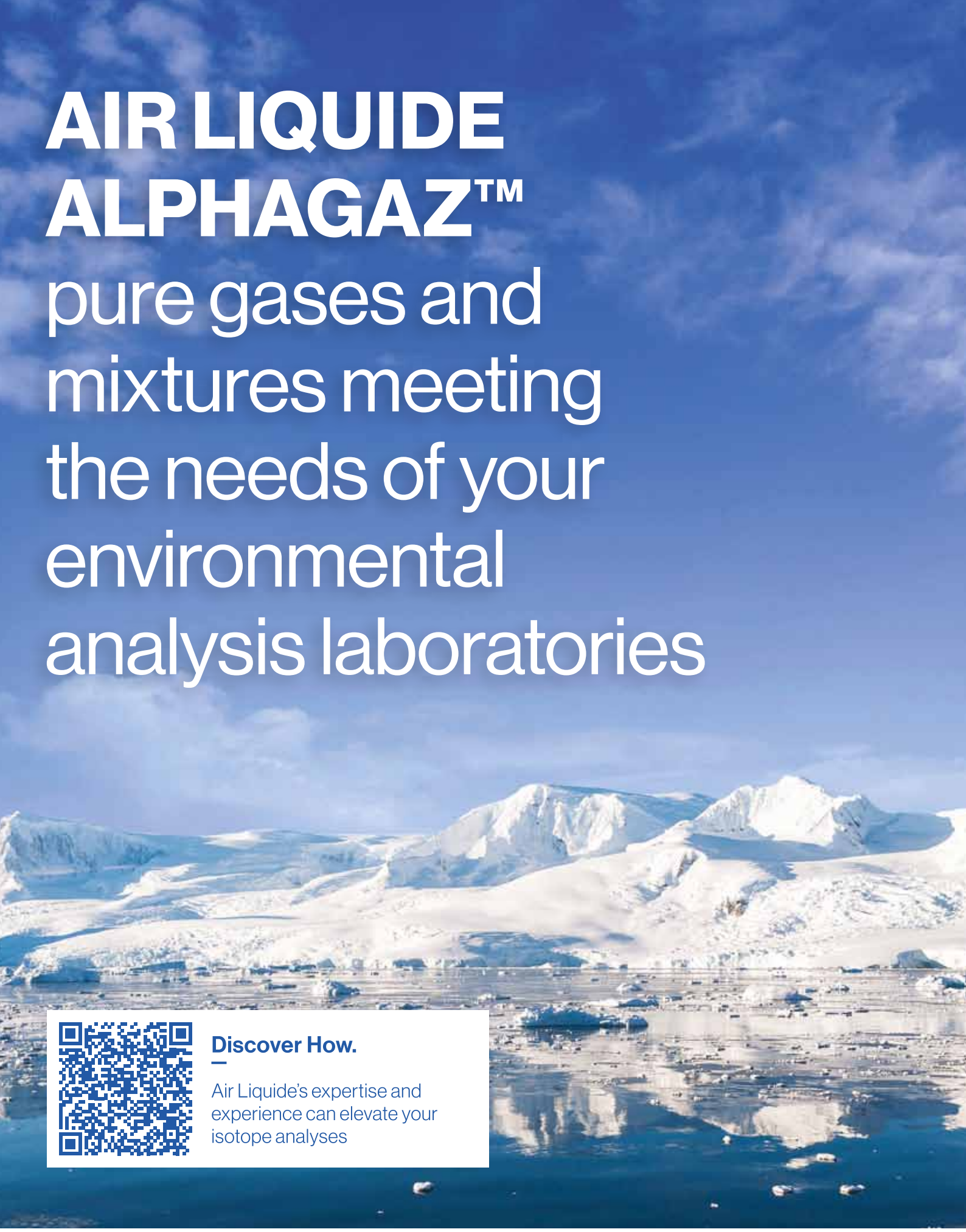
"Our findings suggest that water and other volatile elements such as carbon and nitrogen did indeed arrive on Earth very late, during the 'late veneer' phase," Dr Fischer-Gödde said.

Co-author Professor Martin Van Kranendonk, from UNSW, said the research relates directly to understanding the origins of life on Earth, how we humans came to be and whether we are truly alone in the universe.

"This is because the results show that Earth did not really become a habitable planet until relatively late in its accretionary history," he said.

"If you combine this with the evidence for very ancient life on Earth, it reveals that life got started on our planet surprisingly quickly, within only a few hundred million years. Now this might sound like a lot of time, and it is, but it is far different from what we used to think — that life took half a billion or even a billion years to get started.

"And this gives hope for finding life on other planets that had a shorter geological history and period of 'warm and wet' conditions than Earth, because if life could get started quickly here, then perhaps it got started quickly elsewhere."



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Microcalorimeter for vaccine formulation stability

Since the recent outbreak of the COVID-19 pandemic, Australian scientists together with colleagues around the world have been working around the clock to speed up the development of a vaccine. To support research in pursuit of accelerating drug discovery and development, it is essential to foster a collaborative environment with access to the latest technologies and expertise.

Differential scanning calorimetry (DSC) is a powerful technique which can used to understand and predict the stability of a potential SARS-CoV-2 vaccine formulation. DSC is considered by the biopharmaceutical industry as the 'gold standard' thermal stability assay, measuring the enthalpy (ΔH) and temperature (Tm) of thermally induced structural transitions of molecules in solution. This information provides valuable insights into protein stability — an important indicator of whether a drug will remain functional during formulation and storage without chemical alteration or aggregation, which can give rise to immunogenic responses and in some cases, patient death.

Malvern's MicroCal PEAQ-DSC microcalorimeter allows the thermodynamic and kinetic stability of proteins, nucleic acids, lipids and other macromolecules to be determined. It is sensitive, simple to use, requires little assay development and no labelling or immobilisation. It is designed to measure tight binding constants (up to $10^{20}M^{-1}$). Integrated software with automated data analysis supports the generation of non-subjective, reproducible data. For high throughput and unattended operation, the MicroCal PEAQ-DSC automated system uses an autosampler for rapid screening of thermal stability for up to 50 samples/day.

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Adam Equipment's Luna lab balances are available in both analytical and precision models. They offer a wide variety of applications for everyday lab use, along with a 24 mm-tall LCD display and data sharing and connectivity via standard USB and RS-232 interfaces.

The analytical models offer capacities from 80 to 250 g with a readability of 0.0001 g, while precision models provide a range of capacities from 220 to 15,000 g with readabilities from 0.001 to 0.1 g. The balances also offer a built-in capacity tracker to guard against potential overloads.

Adam Equipment Inc
www.adamequipment.com

Autoclaves for viral inactivation

An autoclave is a device that uses steam to sterilise equipment and other objects. This means that all bacteria, viruses, fungi and spores are inactivated. For those in research, TOMY offers its SX series of compact top-loading autoclaves to meet users' sterilisation requirements.

Available in three capacities — 44, 58 and 79 L — the units take up little space and do not require expensive plumbing as they have a built-in steam exhaust bottle. Powered by 240 V 50 Hz (10 or 15 A model dependent) the units require no specialised electrical supply. With a selectable temperature range from 45 to 135°C , the unit can be programmed for the user's appropriate sterilising course whether it be liquid sterilising, standard sterilising, sterilising with a warming course or heating with a warming course (for dispensing media). The last run memory maintains the last program settings selected.

When the unit has cooled to safe opening levels (lid safety interlocked), the foot pedal releases the lid lock, ensuring lid opening with minimal effort. The cooling fan provides rapid air cooling of the chamber vessel, which should result in shorter/faster cycle times. The LED display shows current status of the autoclave and the auto-variable exhaust speed function allows the exhaust valve to open automatically after completion of the sterilisation cycle. Safety is ensured with lid interlock and water level detection preventing dry heating. Options include printer, external load temperature sensor, data output and additional baskets.

The units are provided with a two-year parts and labour warranty.

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Liz Ashforth, Technical Marketing Manager

AI predicts which ovarian cancer treatment is best for each patient

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Ovarian cancer is the sixth most common cancer in women, and it is a particularly deadly cancer. The five-year survival rate is only 35 to 40% — considerably lower than the survival rates for breast cancer (87%), endometrial cancer (79%) and cervical cancer (67%).

Today, ovarian cancer is diagnosed with a blood test and a CT scan. The blood test looks for CA125, a substance indicating the possible presence of cancer, while the CT scan helps to create a picture of the tumour. This information provides some insight into the severity of the cancer but does not provide detailed insight into which treatment is best for each individual patient.

New research using artificial intelligence (AI) has the potential to improve the way medical professionals treat the disease. Researchers have developed machine learning software called TEXLab, which forecasts the survival rates and response to various treatments for each individual patient.

According to *PharmaTimes*, "The software, created by researchers at Imperial College London and the University of Melbourne, has been able to predict the prognosis of patients with ovarian cancer more accurately than current methods, and can also predict what treatment would be most effective for patients following diagnosis."

"Long-term survival rate for patients with advanced ovarian cancer is poor despite advancements in treatments. There is an urgent need for new ways," said Eric Aboagye, PhD, professor at Imperial College London.

Aboagye led a team of researchers at Imperial College London and the University of Melbourne that developed a machine-learning algorithm to create more targeted treatment plans and more accurately predict the prognosis of patients diagnosed with ovarian cancer. Their work was recently published in *Nature Communications*.

TEXLab, machine learning software developed in MATLAB, analyses ovarian cancer tumours and identifies which treatment will likely be most effective for each patient. The trial took place at Hammersmith Hospital, part of Imperial College Healthcare NHS Trust.

"Our technology is able to give clinicians more detailed and accurate information on how patients are likely to respond to different treatments, which could enable them to make better and more targeted treatment decisions," Aboagye said.

TEXLab examined four characteristics of the tumour — the structure, shape, size and genetic make-up — to assess the patients' prognosis and each patient received a score known as Radiomic Prognostic Vector (RPV) to indicate the severity of the disease, ranging from mild to severe. The team used image processing techniques, including wavelet decompositions, to analyse the CT images. All algorithms were implemented in MATLAB.

The researchers compared the results with blood tests and current prognostic scores used by doctors to estimate survival. They found that the software was up to four times more accurate for predicting deaths from ovarian cancer than standard methods.

Future studies are planned to research how accurately the software can predict surgical outcomes, and how individual patients will respond to treatments. The use of artificial intelligence to improve patients' prognosis and treatment plans is a huge step forward in non-invasive cancer treatment.

MathWorks Australia
au.mathworks.com

Re-scan confocal microscopy imaging system

Re-scan confocal microscopy (RCM) is a super-resolution technique based on standard confocal microscopy extended with an optical (re-scanning) unit that projects the image directly on a CCD-camera. The microscope is designed to have improved lateral resolution (170 nm at 488 nm excitation) and improved sensitivity, while maintaining the sectioning capability of a standard confocal microscope. It is particularly useful for biological applications where a combination of high resolution and high sensitivity is required.

The RCM (1.1) from Confocal.nl is an upgraded version of the RCM (1.0) imaging system. It is suitable for small labs with limited budgets but demanding tasks, particularly when high sensitivity and resolution are desired from the imaging system. The confocal microscope works as a camera and there is no need for an instruction manual. RCM is easy to use as there is no hardware control or software processing needed, and the images are always RAW.

The standard resolution of the RCM is 170 nm at 488 nm wavelength. This is also called super-resolution. In contrast to other super-resolution systems, RCM offers the super-resolution of the live image without any processing. Deconvolution can be used to improve the RCM resolution even further to 120 nm.

The frame rate of the RCM is 1 fps at 512 x 512, which makes the acquisition time of a three-colour image about 3 s. The frame rate of RCM 1.1 can be increased to 4 fps at 512 x 512, which makes the acquisition time of a three-colour image less than 1 s.

RCM 1.0 has a field of view (FOV) of 80 x 80 μm at 100x magnification; RCM 1.1 has the option to increase this FOV to 160 x 160 μm. RCM 1.1 is available in a VIS and NIR version.

RCM can be delivered as a total microscope system with a selection of microscopes, cameras and laser solutions. For those who already have a microscope in their lab, RCM can easily be added to the existing wide-field fluorescence microscope system to improve its resolution.

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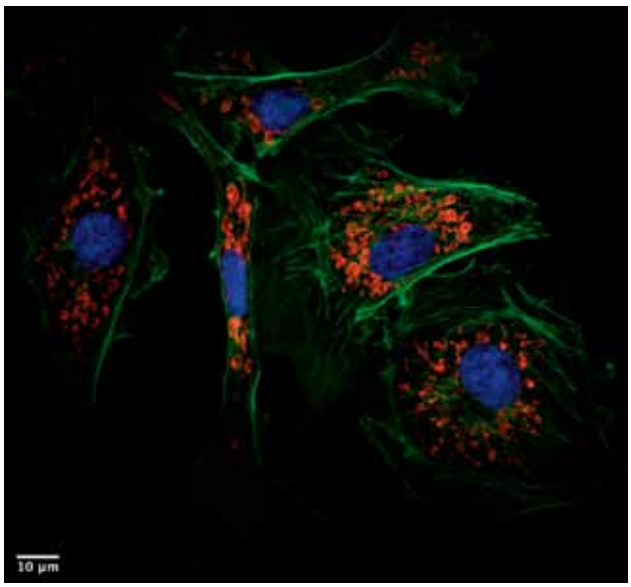
www.scitech.com.au



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Process pumps reduce TCO for Westfield Medical

Westfield Medical, a UK manufacturer of single-use packaging solutions for hospital sterilisation and medical device applications, has fitted six of its machines with 530UN/R2 peristaltic process pumps from Watson-Marlow Fluid Technology Group (WMFTG), which have replaced rotary pumps after repeated failures were encountered. The move has led to a reduction in downtime at the company's Somerset facility, and cut the cost of maintenance and replacement parts.

Established in 1984, Westfield Medical has grown to become a leading manufacturer of single-use sterilisation barrier systems. The company's products include a comprehensive range of bags, pouches, reels, wraps, tray liners and accessories, which are used in over 90 countries worldwide.

Westfield Medical's bespoke manufacturing service has been developed to produce specified sizes and special prints, as well as form fill and seal packaging, plain and printed sheet stock and a complete range of plain and printed top and bottom webs. The company's in-house manufacturing capability includes multicolour flexographic printing, so that customer-specified designs can be produced on a variety of materials — including plain, crepe, registered adhesive and all-over coated papers, coated and uncoated Tyvek, and a variety of co-extruded and laminated materials.

When packaged medical items are used, to ensure the necessary levels of sterilisation are achieved, a special ink marker is deployed as an indicator. However, with a viscosity higher than standard ink, the marker was proving problematic to pump on six bag production machines featuring flexographic printing capability.

"We were using rotary pumps, but unfortunately they began seizing on an increasingly frequent basis; in fact, we began encountering issues every month," said Ben Begue, Continuous Improvement Manager at Westfield Medical. "We experienced a particularly bad phase with the pumps in late 2018 and decided enough was enough. This led us to undertake some online research into alternative pumps, which in turn pointed to peristaltic technology."

Westfield Medical contacted WMFTG and was recommended the 530UN/R2 process pump, one of which was supplied for a four-week trial. According to Begue, "Even after the first week we could see that it would be successful. We returned after Christmas and the machine with the 530 series pump started up straight away, whereas the other five printing machines all needed pump repairs prior to starting. The purchase price of the 530 pump is higher, but the savings associated with reduced downtime, maintenance and spare

parts make the total cost of ownership [TCO] far less, especially across six machines."

Westfield Medical made a commitment to buy six Watson-Marlow 530UN/R2 pumps, with the trial pump remaining on loan until deliveries commenced in March 2019. Since installation of the six pumps there have been no reliability issues, with the only replacement part being the Marprene tubing, which lasts about three months and takes just minutes to change.

Peristaltic pumps are positive displacement pumps which contain the fluid being metered or transferred within a flexible tube. Rollers in the peristaltic pump compress the tube as they rotate, creating a vacuum which draws fluid through the tube. Nothing but the pump tube touches the fluid, eliminating the risk of the pump contaminating the fluid or the fluid contaminating the pump. Fluid is drawn into a pump tube, trapped by the pumphead roller and expelled when the next roller passes over the tube. As the rollers rotate, a vacuum is formed in the tube, pulling in more fluid, for the next roller pass. The complete closure of the tube when is it occluded (squeezed) between the roller and the track gives the pump its positive displacement action, preventing backflow and eliminating the need for check-valves when the pump is not running. The pumps are virtually maintenance-free as there are no seals, valves, diaphragms or rotors to leak, clog or corrode.

At Westfield Medical the 530UN/R2 pumps are used in continuous mode, although the actual flow rate is quite low. Since installation and set-up, each pump has been left to run day in, day out, without the need for any adjustment, even in hot weather, when the company dilutes the ink marker slightly to compensate for thermal effects.

Watson-Marlow 530 series pumps are intuitive, secure and maintain process integrity in applications with flow rates up to 3.5 L/min at 2 bar pressure. Various drive and pumphead options are available, along with a wide range of tube sizes and materials.

As a result of the success achieved with the 530 series pumps, Westfield Medical plans to embark on a trial with a larger 730 series pump on one of its bag production machines. Begue explained, "The machine uses an air-operated diaphragm (AOD) pump to apply glue that seals the bottom of the bag. However, we're having trouble with the actual diaphragm, which is perishing. Although we are not quite ready yet, we're very keen to try the 730 series pump from Watson-Marlow, for which we have high hopes."

Watson-Marlow Fluid Technology Group
www.wmftg.com.au

3D imager

The TruLive3D Imager from Luxendo is optimised for fast 3D multisample imaging of delicate live specimens in their native 3D environment. The optical concept, with dual-sided illumination and single-lens detection from below, enables fast acquisition speed, high-resolution imaging and minimal shadowing effects. The system is especially suitable for multiposition imaging of small embryos (eg, zebrafish, drosophila or mouse), 3D spheroids, organoids, oocytes, tracking stem cell development and differentiation, in vitro fertilisation research and monitoring, and more.

The sample chamber in the imager fits a large sample holder (length: 75 mm), which can accommodate tens to hundreds of samples. The ready-to-use TruLive3D Dishes are fully compatible with the TruLive3D Imager. The possibility to line up three disposable dishes extends the capacities of the system to enable the parallel imaging of samples grown under different media conditions.

The imager can achieve a resolution down to 255 nm in xy, enabling resolving subcellular structures in living samples free of phototoxic effects. Its compact, robust and vibration-free design provides stability even during long-term high-throughput experiments. Luxendo's browser-based user interface offers a simple set-up and execution of multidimensional experiments, while real-time control is handled by an embedded controller to ensure microsecond precision timing independent of the PC's performance fluctuations.

The system ensures easy sample mounting and handling, robust data acquisition pipeline and scaling of experiments. It enables minimised shadowing effects, 3D reconstruction, 5D/6D analysis, tracking of cellular and subcellular events, and morphological analysis.

Key features of the illumination optics include chromatic correction from 440 to 660 nm; light-sheet generation by beam scanning; flexible light-sheet thickness (2 to 6 μm); and two Nikon CFI Plan Fluor 10x W 0.3 NA water immersion objective lenses. Key features of the detection optics include one Nikon CFI Apo 25x W 1.1 NA water immersion objective lens; two spectral detection channels, each equipped with a fast filter wheel (10 positions and 50 ms switching time between adjacent positions); filters adapted to the selected laser lines; two high-speed sCMOS cameras; and a maximum frame rate of >80 fps at full frame (2048 x 2048 pixels of 6.5 μm x 6.5 μm size) and up to 500 fps at subframe cropping and peak quantum efficiency (QE) of 82% @ 560 nm.

SciTech Pty Ltd
www.scitech.com.au

Liquid handler for automating protein purification

The JANUS G3 BioTx automated workstations deliver consistent small-scale protein purification and sample prep for protein characterisation needed to support quality by design experimentation in both upstream and downstream processes.

They accommodate column, tip and batch chromatography modes on one platform. With just one instrument, a range of sample volumes and concentrations can be rapidly analysed. Easy-to-use protocols enable walk-up usability without advanced training, along with the flexibility needed to easily modify purification parameters.

The JANUS G3 BioTx workstations are designed to provide researchers with more time to focus on new analytical tests, obtaining critical information earlier in the protein development pipeline. Time and labour savings should accelerate project workflows and the commercialisation of protein therapies.

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

PerkinElmer Pty Ltd
www.perkinelmer.com

Benchtop SEM

The NeoScope JCM-7000 from JEOL produces high magnification up to 100,000x with large depth of field. It features a large sample chamber, high and low vacuum modes, secondary and backscatter electron detectors, real-time 3D imaging, advanced auto functions and the option to add a fully embedded EDS with real-time 'Live' analysis.

The JCM-7000 introduces the 'Zeromag' function, enabling seamless transition from the colour optical image to an SEM image. This allows users to quickly focus on areas of interest, acquiring high-resolution images instantly, along with live elemental analysis (EDS required). Such a function has previously only been available on full-sized SEMs, the company says.

In addition to live SEM images, the NeoScope can display live 3D images of the sample surface, including valuable depth information about the sample. The advanced technology and functions in the device make it simple for users at any skill level to obtain high-quality SEM images and elemental analysis results in minutes. Price is fixed in AUD.

Coherent Scientific Pty Ltd
www.coherent.com.au

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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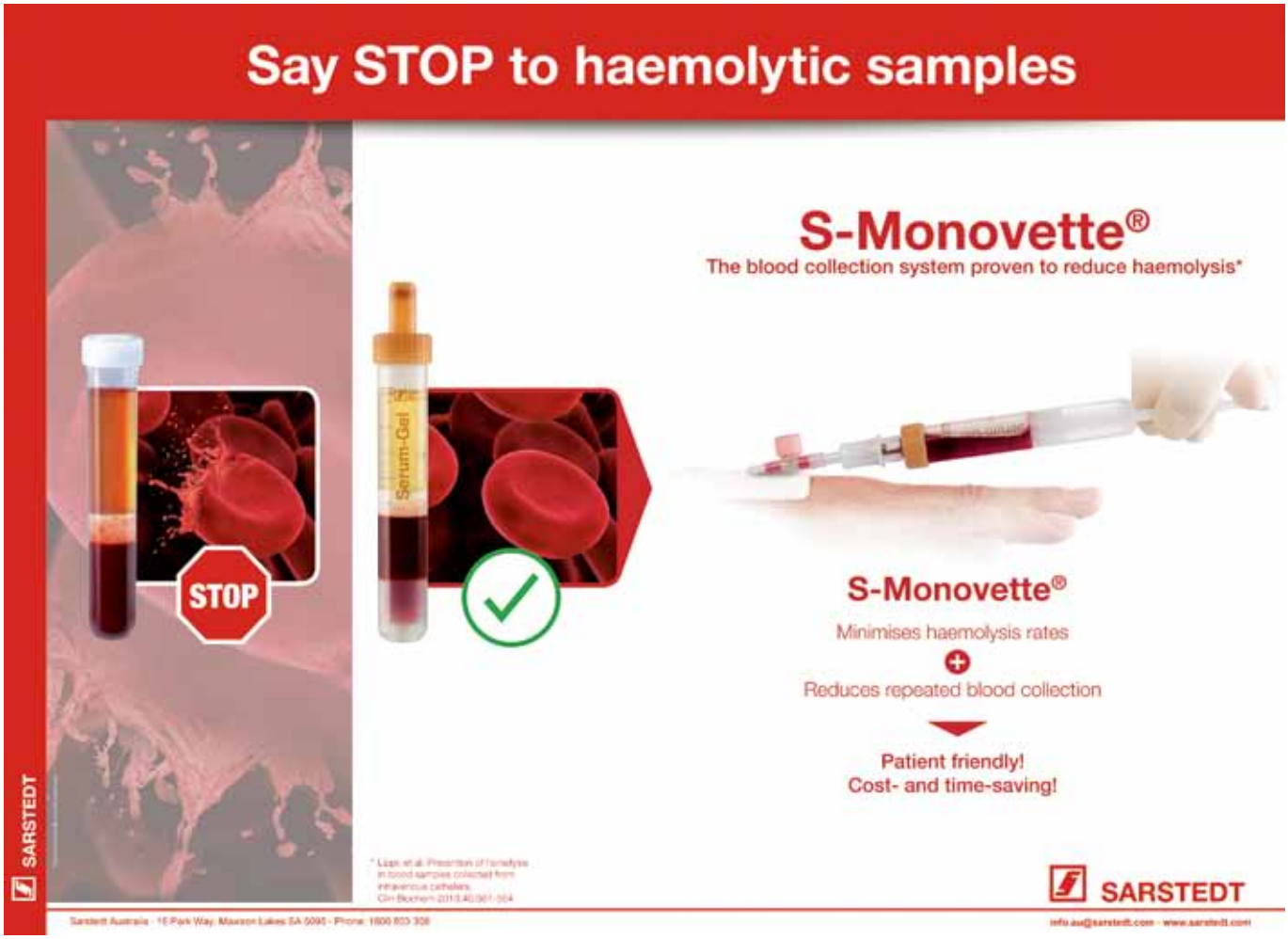
www.sarstedt.com



Ensuring traceability in Australian and New Zealand laboratories

Traceability is now a common part of accreditation systems and business expectations.

With major audits conducted in Australian and New Zealand laboratories every two to four years, assessors are tasked with checking all necessary documentation to ensure accreditation is maintained. This process checks that the laboratory has the correct practices and quality systems in place to undertake the work they are contracted to do.

Failure to provide the right documentation and certificates can lead to corrective actions and, in some cases, loss of accreditation. This can have vast implications on the overall business. Put simply, if your accreditation is at risk, your business is at risk.

In recent years, traceability has become an increasing focus for assessors. Advancements in technology have seen an increasing number of businesses use analytical processes as part of their systems. This has led to a greater understanding of traceability, which is now a common part of accreditation systems and general business expectations.

For example, accreditation is important for laboratory managers in the food sector, with requirements around residue testing which can have significant impacts for food exporters. In the instance that a residue test fails and food has already been exported, this may result in food being dumped, which would have massive cost implications for the business.

In the defence sector, certification is of critical importance. For example, in a submarine where there is welding gas used to perform critical welds, businesses must prove that the welding gas meets a certain

specification. Otherwise, if something happens to the submarine because of the weld, the liability sits with the business. For multibillion-dollar projects, the cost of using appropriately certified products becomes negligible. On these types of projects, customers need to use products that come with traceability so they can demonstrate they've used the right product if an accident were to happen.

What is traceability?

Traceability is how we know that a measurement is accurate. It involves linking the value that we say we have achieved to an international measure. It involves comparisons in measurements and considers how many steps are involved. A high level of traceability is something that has fewer 'steps' in the traceability chain. The fewer steps involved, the better, as there is less risk for error and lower uncertainty about the measurement.

Why is traceability so important?

Traceability is vital in ensuring measurements are accurate and that they meet required standards. Failing to use an accredited standard could break the traceability chain, costing time and money.

For example, if a laboratory were to use pure gas without a certificate to calibrate an instrument, they could be subject to corrective action in an audit. Pure gases are sold with a minimum purity, but they are not certified as such. Helium 99.99%, as an example, could be 99.99% pure or 99.995% pure or 99.9999% pure, but because the actual value is unknown, it can't be used to calibrate an instrument. Therefore, it breaks the traceability chain because it is not certified. Using a certified pure gas provides the confidence that the instrument has a certified percentage of purity and the accredited certificate to back it up. If an accredited standard is not used, it could invalidate analytical results used for the period in which the unaccredited pure gas is used, wasting time and money.

By using reputable suppliers (ie, accredited ones) who meet high standards, decision-makers in laboratories can rest assured that they are operating to internationally accredited standards.

Conclusion

Traceability is an increasing focus for assessors and is of vital importance for Australian laboratories to demonstrate the quality of testing. Standards, accreditations and certificates are all important aspects for laboratory managers to consider to ensure traceability.

When preparing for an upcoming audit, laboratory managers should ensure they have all evidence together to show how they've used the correct reference materials made under a standard, by an accredited company with a valid certificate. If they are unsure about the traceability of their products, they should reach out to their gas supplier.

It is highly advisable to speak to a specialist and make sure you have the right level of certification and accreditation for your business.

BOC has a large team of scientific specialists who can advise on the correct gases to use, and are supported by a technical team. A simple conversation today can save a painful corrective action later. BOC also has the capability to supply documentation online for ease of doing business.

BOC Limited
www.boc.com.au

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DNA-Seq library preparation kit

Tecan's Rapid EZ DNA-Seq library preparation kit is designed to offer PCR-free generation of sequencing-ready libraries for next-generation sequencing (NGS). Suitable for whole genome sequencing and metagenomics for samples with varied GC content, as well as amplicon sequencing, the automation-friendly kit complements Tecan's existing Celero, Rapid and Ovation Ultralow DNA-Seq library preparation solutions.

The library preparation kit is an end-to-end solution for PCR-free generation of NGS libraries in 2.5 h. The kit uses Tecan's robust enzymatic DNA fragmentation and DimerFree library construction technologies, eliminating the need for tedious optimisation regardless of input amount. It offers an 'add and incubate' workflow, making it suited to applications sensitive to PCR bias or PCR artefacts, such as microbiome and prokaryotic samples, or sequencing of GC- or AT-rich regions of the human genome.

The kit includes all of the reagents needed for library construction, with pre-plated Unique Dual Index (UDI) adaptors to enable flexible multiplexing and detection of 'index hopping'. The simple, flexible workflow can be easily automated on Tecan's liquid handling platforms, such as the DreamPrep NGS workstation.

Tecan Australia
www.tecan.com.au

Digital laboratory management platform

Laboratory digitalisation and connectivity to improve laboratory efficacy is no longer a foreign idea or a futuristic goal. It is now an industry trend to observe smooth transition and integration of the physical and virtual laboratory.

In line with current global trends, Eppendorf is introducing VisioNize software, a digital platform designed to deliver valuable services on VisioNize onboard devices. The cloud-based software is designed to facilitate smart laboratory management by minimising instrument downtime as faster corrective actions can be executed in the event of emergencies, hence minimising disruption to laboratory productivity. The software helps in archiving instruments' performance data for traceability, a common requirement in regulated accounts.

By subscribing to VisioNize via a myEppendorf account, users can expect to experience seamless and futureproof connectivity to their VisioNize onboard devices. Eppendorf onboard devices include the CryoCube F740hi ULT Freezer, CellXpert C170i CO2 Incubator, SciVario twin Bioreactor Control System, Innova S44i Shaker Incubator and the PCR Cycler Mastercycler X50.

The software consists of services that are accessible via the VisioNize Digital Lab Space to enhance laboratory productivity by increasing efficiency, promoting convenience and offering peace of mind. The services hosted include remote device monitoring, alarm notifications via email and SMS as well as defining recurring service tasks. As well as being directly accessible via the onboard devices' interface, VisioNize is connectable remotely via web browsers on desktops, laptops, tablets and smartphones.

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

Liquid handler for miniaturisation of genomic workflows

Beckman Coulter's Echo 525 Liquid Handler is said to be the first rapid acoustic liquid handler designed specifically for biochemical and genomics reagent transfer, enabling scientists to spend more time looking at data. Protocol creation and implementation in the Echo Software Applications are fast and do not require extensive training. Designed for use with the Echo system, the Access Laboratory Workstation expands the Echo 525 Liquid Handler's utility and further frees up time.

Precise, low-volume transfers enables assay miniaturisation. The product is said to build assays 50–100 times faster than traditional liquid handlers, giving the lab higher capacity from one instrument. The suite of Echo Software Applications guides creation of complex protocols for a variety of applications. The product also eliminates pipetting variances that affect assay success and integrates into the Labcyte Access Laboratory Workstation for increased throughput.

The flexibility, speed and precision of the liquid handler should enable researchers to build assays that are not possible with traditional liquid handlers. The use of acoustic sound energy removes the traditional boundaries of tip and pin tool based liquid handlers. Transfer variable fluid heights and viscosities from one source plate to enable rapid assay creation in one fluid transfer run. The liquid handler moves fluids from any well to any other well, enabling researchers to design the experimental plates they need to make discoveries.

Assay assembly and the transfer of one reagent to many wells is simplified using the Echo Qualified Reservoir. With the capability of transferring up to 2.5 mL from each micro-well, users can build assays without requiring an instrument change.

The liquid handler transfers a wide range of fluids during one transfer including distilled water, buffers, nucleic acids, and reagents containing up to 50% glycerol. With its versatile fluid range, transfer volume range, any well to any well transfer capability and powerful applications software, the product supports a wide range of genomic assay workflows, including gene synthesis, PCR and qPCR assay set-up, RNA and DNA NGS sequencing workflows, Sanger sequencing assay set-up and single-cell sample preparation.

Beckman Coulter Hong Kong Ltd

Multiparameter water testing photometer

The MD 610 is a modern, mobile photometer for rapid water testing. Measuring over 120 pre-programmed parameters in one photometer, with a range of reagents available in powder packs, tablets or liquid form, the MD 610 should suit the majority of applications in the water testing industry.

Software updates can be downloaded for free as additional test methods become available to keep the instrument up to date. The scroll-driven menu system allows user to navigate to the desired test with ease and save as favourites for quick access.

Users can store up to 1000 readings with location ID, time and date stamp. Test data stored on the instrument can be easily exported using the IRiM accessory or via the free AquaLX app to export data to an Excel-compatible CSV file. A Bluetooth interface allows for the sending and sharing of test data directly from the field.

The optical system of the MD610 series operates with six unique wavelengths. By utilising LEDs and interference filters, the instrument quickly gives reproducible results that the user can be confident in. One-time-Zero Function eliminates the need to re-zero the instrument with every test when testing a new sample.

Designed with portability in mind, the MD610 is supplied in a carry case with a whole range of accessories to get users testing straight away.

Labtek
www.labtek.com.au

Laboratory balances

The range of Solis laboratory balances includes semi-micro, analytical and precision models that combine intuitive operation with acute precision for complex weighing tasks. The high-resolution graphic display shows clear results and includes a capacity tracker that allows users to quickly check for overloads. The arrows and buttons are easy to read for smooth navigation through the menus. Semi-micro models are dual range with capacities of 120 and 220 g and readabilities of 0.01 mg in the fine range, while high-capacity analytical units go up to 510 by 0.0001 g.

Versatile and resilient, the balances are suitable for use in research and quality assurance labs, science education, precision counting, production and manufacturing applications. They offer valuable features like formulation, density determination and dynamic weighing to labs that perform detailed testing. The Solis can store up to 99 ingredients and features a percentage weighing function to simplify formulation. The peak hold and animal weighing features are designed to ensure that moving animals and unstable substances such as liquids can be weighed with high precision. Selectable digital filtering helps to further minimise the effects of vibrations and disturbances.

An RS-232 interface provides speedy transmission of data to computers and printers. GLP-compliant printouts include the date and time for tracking. The stainless steel weighing pan is sturdy and easy to clean, with a 304 grade that allows users to work with various chemicals without damaging the balance. Models are available with internal automatic and external calibration options.

Adam Equipment Inc
www.adamequipment.com

Kits for western blot analysis

The WESTERNVIEW Detection Kits for western blot analysis, from Enzo Life Sciences, quickly and clearly reveal bands on the transfer membrane without the need for specialised equipment. Users can stop guessing exposure time as the signal develops in front of their eyes.

The kits have high sensitivity for low expressing markers such as Caspase-7 with low background, due to the use of a proprietary polyenzyme technology. All kits are compatible with PVDF and nitrocellulose membranes and are simple to use with all reagents ready to use or ready to dilute.

The ability to determine the source of protein bands with differentiated colours makes the kits amenable to multiplex analysis. They are available in anti-mouse, anti-rabbit and dual-format versions.

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

www.labbench.com.au

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Australian bench manufacturer LabBench has worked alongside research engineers to develope a modular instrument bench range suited to LC, GC and MS instrumentation. Standard widths are 655mm, 965mm and 1278mm with a Maxi-TOP range to extend to 1700mm wide. Heights are 800-825mm and 755mm deep. Custom bench sizes and designs are also available. For enquiries email **supplyme@labbench.com.au**

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The LabBench range offers incorporated and flexible PC hardware and mounting systems along with various storage solutions such as illuminated chemical waste cupboards, general shelving and soft touch drawers. Instrument power, chemical and vacuum lines integrate to allow a mobile unit. Personal USB charging ports and locking mechanisms .

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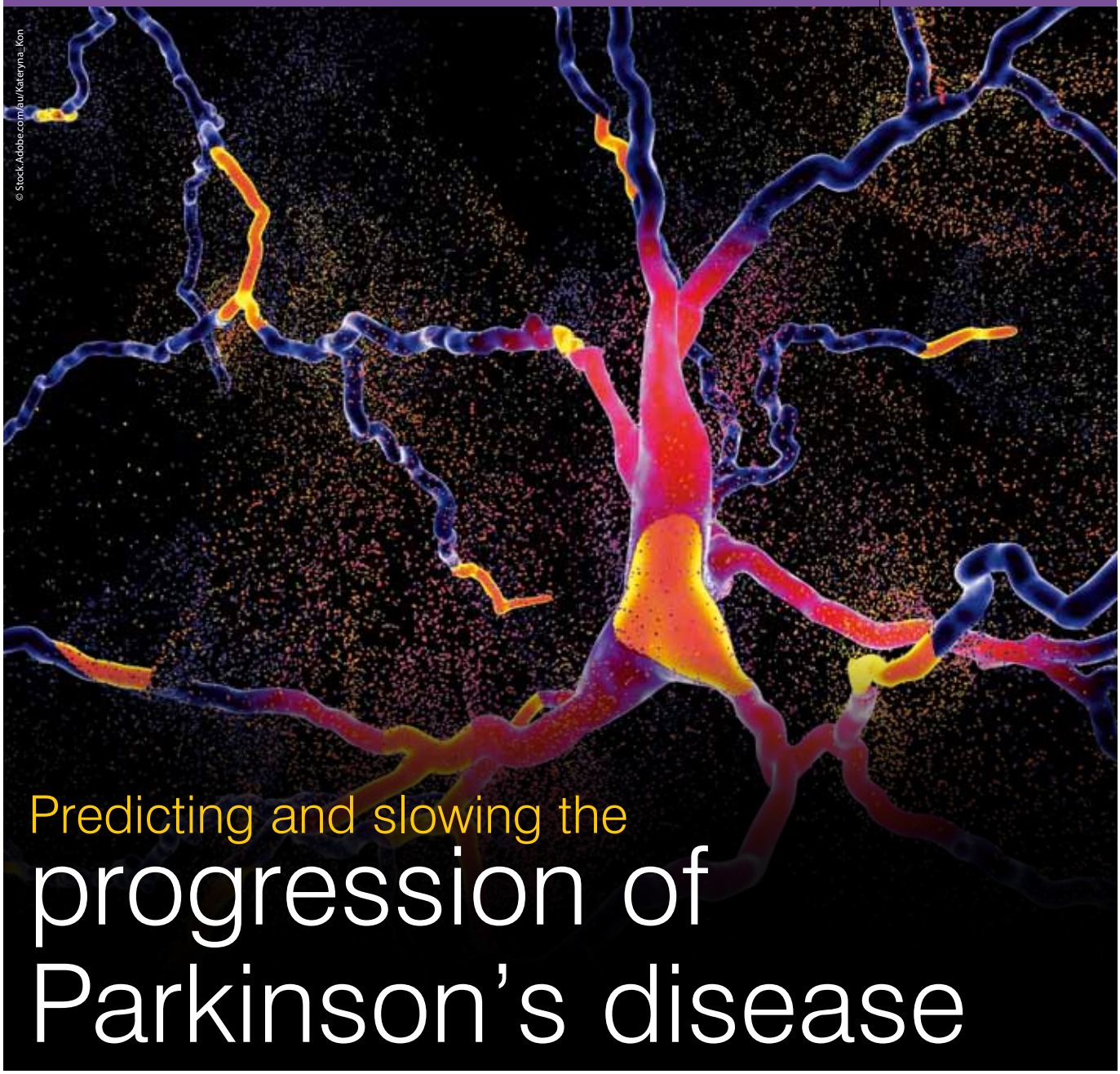
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Predicting and slowing the progression of Parkinson's disease

Two recent studies have provided new hope for patients with Parkinson's disease (PD), offering potential strategies for predicting the disease's progression as well as bringing it to a halt.

In order to provide the best medical care for newly diagnosed PD patients, a method of predicting their cognitive and motor progression, beyond using purely clinical parameters, would have major implications for their management. UK scientists, writing in the *Journal of Parkinson's Disease*, have now suggested that a blood test for inflammatory and cell senescence biomarkers may be a reliable predictor of cognitive decline, including identifying those who will develop an early dementia and motor progression.

"PD is known to be associated with inflammation, and we have previously published data demonstrating that a more pro-inflammatory profile in the blood predicts more rapid clinical progression," said lead investigator Dr Gabriele Saretzki, from Newcastle University. "In this new study, we sought to replicate this finding as well as to study markers of cell senescence (ageing) — a process that is known to be associated with inflammation and neurodegeneration."

Investigators examined the association of blood-derived markers with motor and cognitive function over time to discover if this could help to better predict disease progression of newly

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diagnosed PD patients. More than 150 newly diagnosed PD patients and 99 controls underwent physical and cognitive assessments over 36 months of follow-up.

Researchers analysed whether markers of cellular senescence, such as telomere length (TL), p16 and p21 expression, as well as inflammatory markers in blood samples taken close to diagnosis, can be predictive of cognitive and motor progression of the disease over the next 36 months. Mean leukocyte TL and the expression of senescence markers p21 and p16 were measured at two time points (baseline and 18 months). Investigators also selected five inflammatory markers from existing baseline data.

The study demonstrated that PD patients had shorter telomeres at baseline and 18 months later compared to age-matched healthy controls. Those PD patients, who had developed dementia after three years, also had significantly shorter telomeres compared to individuals who were dementia-free at this time. Baseline p16 levels were associated with faster rates of motor and cognitive decline over 36 months, while a simple inflammatory summary score at baseline best predicted cognitive score 36 months later in PD patients.

"The development of suitable blood-based biomarkers to predict outcomes is important for neurodegenerative diseases such as PD, which progress over many years," Dr Saretzki noted. "The markers that we have identified need to be validated in further studies but could ultimately help with planning more targeted management for patients earlier in their disease course. Furthermore, a better understanding of the biological changes that predict disease course has implications for possible future therapies for the disease."

"The development of suitable blood-based biomarkers to predict outcomes is important for neurodegenerative diseases such as PD" — Dr Gabriele Saretzki

Meanwhile, researchers from the University of Helsinki have discovered a promising molecule, called BT13, that has the potential to both boost levels of dopamine — the chemical that is lost in PD — as well as protect the dopamine-producing brain cells from dying. Their study, published in the journal *Movement Disorders* and co-funded by Parkinson's UK, suggests that BT13 could have the potential to lead to a new drug treatment that can slow, stop or even reverse the loss of brain cells in PD.

Typically, by the time people are diagnosed with PD, they have already lost 70–80% of their dopamine-producing cells, which are involved in coordinating movement. Current treatments mask the symptoms, but there is nothing that can slow down its progression or prevent more brain cells from being lost. As dopamine levels continue to fall, symptoms get worse and new symptoms can appear.

Now, scientists have found that treatment with BT13 showed an increase in dopamine levels in the brains of mice. The molecules also activated a specific receptor in the mouse brains to protect the cells. The researchers are now working on improving the properties of BT13 to make it more effective as a potential treatment.

"We are constantly working on improving the effectiveness of BT13 and we are now testing a series of similar BT13 compounds," said Dr Yulia Sidorova, lead researcher on the study. "Our ultimate goal is to progress these compounds to clinical trials."

The team's study builds on previous research on another molecule that targets the same receptors in the brain, glial cell line-derived neurotrophic factor (GDNF), an experimental treatment for PD which was the subject of a major clinical trial funded by Parkinson's UK. But whereas the GDNF protein requires complex surgery to deliver the treatment to the brain because it is a large molecule, BT13 is a smaller molecule and could thus be more easily administered as a treatment.

"People with Parkinson's desperately need a new treatment that can stop the condition in its tracks, instead of just masking the symptoms," said Professor David Dexter, Deputy Director of Research at Parkinson's UK.

"One of the biggest challenges for Parkinson's research is how to get drugs past the blood-brain barrier, so the exciting discovery of BT13 has opened up a new avenue for research to explore."

Anion suppressor ion chromatography system

Shimadzu's HIC-ESP, an anion suppressor ion chromatograph with a built-in electrodialytic suppressor, features the same low carryover and injection precision characteristic of the company's HPLCs. The system is suitable for applications in a wide range of fields including environmental science, medicine, chemistry and food science.

The product's ICD-40A anion suppressor unit achieves high efficiency and stable suppressing while maintaining a small internal volume, due to an eluent flow path that bends back around and an optimised dialytic. The unit reduces peak spreading — increasing the sensitivity for components with low retention such as fluorine ions — and improves water dip separation, providing stable functionality even over long periods of use.

Using an electrodialytic system that can carry out analysis and regenerations simultaneously, the analysis cycle time can be reduced and consecutive regeneration achieved, increasing the flexibility of the analysis time settings. In addition, the suppressor uses waste solution from the detector as regenerating solution, making environmentally unfriendly regenerating solutions such as sulfuric acid unnecessary.

Shimadzu Scientific Instruments (Oceania) Pty Ltd
www.shimadzu.com.au

Laboratory refrigerators and freezers

PHCbi designs and manufactures a range of pharmaceutical fridges, biomedical freezers and ULT -86°C freezers, with stringent evaluation and checkpoints to ensure a high level of quality.

Depending on their requirements for -86°C freezers, the user can prioritise sample integrity with twinguard technology or reduce the burden of ownership with ECO VIP energy savings. As a sample storage solution, the PHCbi -150°C freezers are said to rival current LN2 storage systems.

The MPR pharmaceutical refrigerators prioritise sample integrity with temperature uniformity, even during defrost cycles. Units can come with drawers or wired shelves to cater to the demands of the lab. Should space be an issue, the PHCbi sliding door units help to reduce the footprint size and, with a range of sizes to choose from, can fit into almost any space.

The MCO CO_2 incubator range offers standardised dry heat sterilisation or a fast decontamination process using hydrogen peroxide vapour, to get research out quickly. 49 L units are available for a personal unit to reduce gas consumption, or grow more cells with 165 and 230 L.

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www.bio-strategy.com

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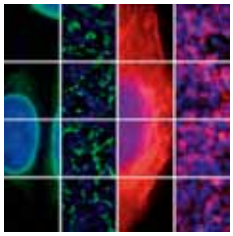

Fluorescent-dye conjugated antibodies

Proteintech's monoclonal and polyclonal antibodies are now available directly conjugated with fluorescent dyes: CoraLite488, CoraLite594 and CoraLite647. They act as useful tools for immunofluorescence studies requiring multiplex co-labelling studies without the need for secondary antibodies.

The antibodies can be used directly in immunofluorescence studies without the need for secondary antibodies. Offering bright and long-lasting fluorescence, they can be multiplexed with other CoraLite dyes and dyes (eg, nuclear stains, DAPI, etc).

CoraLite fluorescent-dye conjugated antibodies are precise tools for a broad range of fluorescent-based research applications such as immunofluorescence, flow cytometry and ELISA-like assays.

The CoraLite dyes have equivalent brightness to the Alexa Fluor line. Additionally, each fluorophore can be used simultaneously in co-localisation studies due to the minimum overlapping fluorescence spectra. The CoraLite line of fluorescent conjugated antibodies are designed to enable faster and simultaneous detection of multiple targets in one experiment.

CoraLite488 is a bright green-fluorescent dye that is suitable for excitation by a 488 nm laser, while CoraLite594 and CoraLite647 are red-fluorescent dyes with maximum absorptions at wavelengths of 594 and 647 nm, respectively.

Millennium Science Pty Ltd
www.mscience.com.au

Pipette tips

Rainin LTS pipette users now have even greater choice when it comes to selecting tips. The Biotix xTIP has been manufactured for compatibility with LTS pipettes, and includes a range of features that users rely on.

The FlexFit feature allows for a secure seal of the tip onto the pipette without needing to force the fit, improving ergonomics and reducing strain. The naturally low retentive X-Resin provides a non-stick tip surface, promoting precision when pipetting with no sample loss. Eliminating the need for tip touch off, the Blade feature is designed to deliver increased reproducibility.

Available in filtered and unfiltered versions, in sizes of 20, 200, 300, 1000 and 1250 μL, the Biotix xTIP for Rainin LTS pipettes also comes with complete certification of RNase, DNase, pyrogen, endotoxin, nucleic acid and trace metal-free status.

Interpath Services Pty Ltd
www.interpath.com.au

COVID-19 RNA control

In an effort to combat the recent coronavirus outbreak, Thermo Fisher Scientific has designed and developed the Thermo Scientific AcroMetrix Coronavirus 2019 (COVID-19) RNA Control as a synthetic RNA, non-infectious control to help labs validate and monitor COVID-19 molecular diagnostic tests. Taking FDA guidelines into account, the controls were carefully designed at two different concentrations: a low positive control and an ultralow positive control.

The control is prepared by formulating synthetic RNA transcripts that contain N, S, E and Orf1ab regions of SARS-CoV-2 (COVID-19) genome into a proprietary buffer. The RNA is ready for reverse transcription, PCR amplification and detection, as appropriate to the test. The kit contains two vials of SARS-CoV-2 specific RNA at the concentration that will result low positive and ultralow positive in most commonly used PCR-based COVID-19 nucleic acid testing methods.

The control is available globally as a Research Use Only (RUO) product and is not intended for clinical use.

Thermo Fisher Scientific
www.thermofisher.com.au

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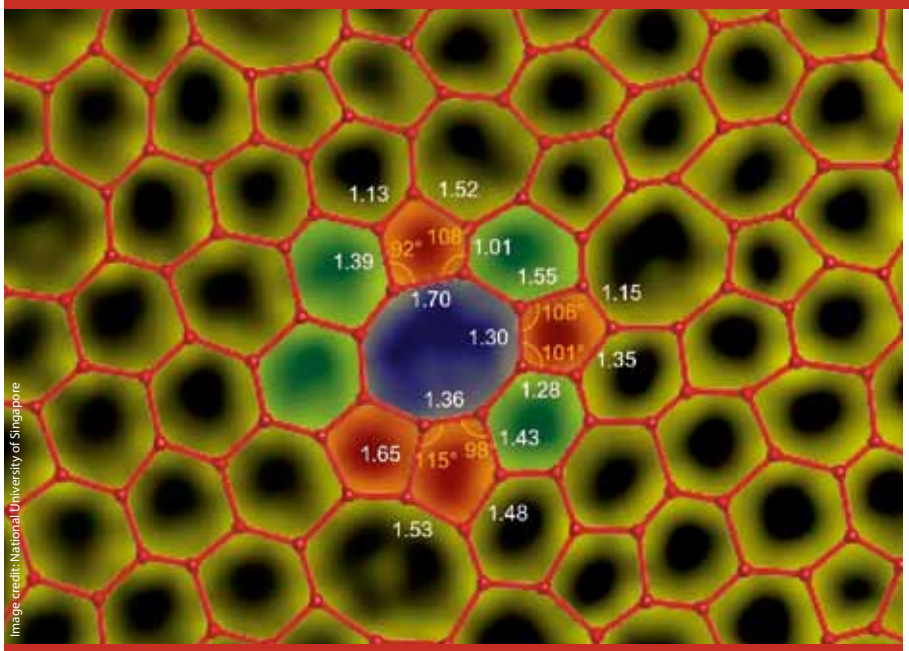


Image credit: National University of Singapore

Left: The amorphous structure has widely varying atom-to-atom distances, unlike crystals. This is because of the random arrangement of five-, six-, seven- and eight-carbon rings in a planar carbon network, leading to a wide distribution of bond lengths (in Å) and bond angles.

Scientists create atom-thick amorphous film

A research team led by the National University of Singapore (NUS) has synthesised what is claimed to be the world's first one-atom-thick amorphous material. Previously thought to be impossible but now described in the journal ***Nature***, the discovery of monolayer amorphous carbon (MAC) could finally settle a decades-old debate of exactly how atoms are arranged in amorphous solids, and open up potential applications.

In the study of amorphous materials, there are two opposing groups. One says that it is possible for materials to have a fully disordered, completely random structure. The other says there is always nanometre-sized order of tiny crystallites, surrounded by random disorder.

The newly synthesised MAC films show the latter arrangement. The researchers see nanometre-sized patches of strained and distorted hexagonal carbon rings, but there is random disorder between these patches. Hence, the MAC films also contain five-, seven-, and eight-membered rings too.

These atomically thin sheets of amorphous carbon are synthesised by using a laser vaporising a carbon-containing precursor gas into an atomically fine mist. This turns the carbon precursors into highly reactive, energetic species which immediately form a MAC film when they hit the surface of almost any substrate.

Despite having a disordered atomic structure, MAC is capable of some incredible behaviour. As noted by Dr Toh Chee Tat, first author of the study, "What is amazing about MAC is that it exhibits some properties that are totally different from traditional monolayer materials."

One such property is that MAC films can be 'plastically deformed'. This means that they can be stretched into irregular shapes, and stay conformed to that position. There is no other single-layer material in existence that displays significant plastic deformation — so the fact that MAC behaves this way, compared to nanometre-thick crystalline materials that would easily snap when stretched, significantly expands the number of industrial applications it could be suitable for.

Holes can even be punched into the material, or it can be torn, and yet the film will retain its key properties. MAC can also be grown on many different substrates, including copper, gold and stainless steel.

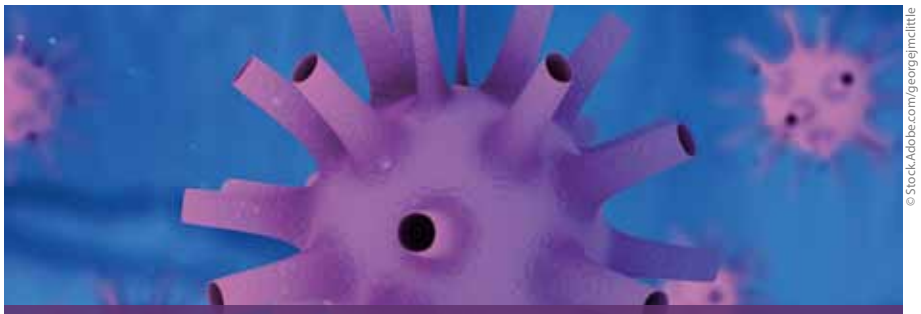
"Everything that is understood from atomically thin crystals — in terms of their properties and how they are analysed — does not apply here," said Dr Toh. "It is a completely new material that we are studying."

The breakthrough was led by Professor Barbaros Özyilmaz, Head of NUS Materials Science and Engineering. He said, "With MAC, we have shown for the first time that fully amorphous materials can be stable and free-standing in single atomic layers. Amorphous materials are of great technological importance, but surprisingly, they remain poorly understood from a basic science point of view. This breakthrough allows for direct imaging to reveal how atoms are arranged in amorphous materials, and could be of commercial value for batteries, semiconductors, membranes and many more applications.

"MAC is much more hardy and cheaper to make than conventional crystalline two-dimensional films. The laser-assisted deposition process through which MAC is synthesised is already commonly used in industry. Hence, we can grow a large-area, defect-free, monolayer film on a wide variety of substrates with high throughput and at low temperature."

This makes MAC a potential low-cost material to address industry needs, and for some applications it may be an alternative to two-dimensional crystals such as graphene. For example, ultrathin barrier films are sorely needed in many industries — for next-generation magnetic recording devices, copper interconnects, flexible displays, fuel cells, batteries and other electronic devices. However, the performance of conventional amorphous thin films is poor when made very thin, and other atomically thin films cannot be produced according to stringent industry standards without compromising their qualities.

"Our monolayer amorphous films not only achieve the ultimate thickness limit, but also do not compromise on uniformity and reliability, and are generally considered viable for industry," said Prof Özyilmaz. He and his team were recently awarded a grant under the National Research Foundation Singapore's Competitive Research Programme to investigate the properties of monolayer amorphous materials, and will be collaborating with industrial partners to accelerate the commercialisation of materials such as MAC.



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Note: all event dates correct at time of writing

With event organisers scrambling to reschedule their conferences in the wake of the COVID-19 pandemic, it's understandable that the first half of our 2020 calendar is looking a little bare. Furthermore, there is every chance that further events may be cancelled, postponed or moved online between the time of writing and when this magazine reaches your (home office?) desk. We encourage you to give it a read all the same, and if any particular events are of interest to you, head to the relevant conference website for more information — most have a running update on how, if at all, they have shifted their plans as a result of COVID-19.

International Statistical Ecology Conference
June 22–26, online
http://www.isec2020.org/

AMSA/NZMSS 2020 Conference
July 5–9, Sydney
https://amsa2020.amsa.asn.au/

14th Asia-Pacific Regional IAU Meeting (APRIM)
July 6–10, Perth
https://aprim2020.org/

International Conference on the Physics of Semiconductors 2020
August 9–14, Sydney
https://www.icps2020.org/

Agriculture Summit 2020
August 14–15, Melbourne
https://agrisummit.net/

43rd COSPAR Scientific Assembly
August 15–22, Sydney
http://www.cospar2020.org/

Energy Oceania 2020
September 7–9, Melbourne
https://www.energyconferenceaustralia.com/

FOODCONF 2020
September 21–23, Melbourne
https://www.foodconferencesaustralia.com/

IAFS 2020
September 21–25, Sydney
https://iafs2020.com.au/

Materials Oceania 2020
September 28–October 1, Brisbane
https://www.materialsconferenceaustralia.com/

Science meets Parliament 2020
October 13–14, Canberra
https://scienceandtechnologyaustralia.org.au/

AACB 58th Annual Scientific Conference
October 20–22, Brisbane
https://aacb.eventsair.com/aacb-58th-annual-scientific-conference/

AusBiotech 2020
October 28–30, Melbourne
https://www.ausbiotechnc.org/

Global Academic Programs (GAP) Conference
November 16–18, Melbourne
https://www.gap2020.com.au/

Linking the Galactic and Extragalactic
November 30–December 4, Wollongong
http://extragalactic-milkyways.org/

Eradicate Cancer 2020
December 14–16, Melbourne
https://www.eradicatecancer2020.org/

ASID Annual Scientific Meeting 2021
March 24–26, Melbourne
https://www.asid.net.au/meetings/ASM2020

TSANZSRS 2021
April 30–May 4, Melbourne
https://www.tsanzsrs2021.com/

20th International Conference on Biological Inorganic Chemistry
July 18–22, Adelaide
https://www.icbic2021.org/

6th International Archean Symposium
July 21–23, Perth
https://6ias.org/

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

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

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A.B.N. 22 152 305 336
www.wfmedia.com.au

Head Office
Unit 7, 6-8 Byfield Street,
(Locked Bag 2226)
North Ryde BC NSW 1670,
AUSTRALIA
Ph: +61 2 9168 2500

Editor
Lauren Davis
LLS@wfmedia.com.au

Publishing Director/MD
Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production
Colleen Sam, Veronica King

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

Copy Control
Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

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

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

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

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

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